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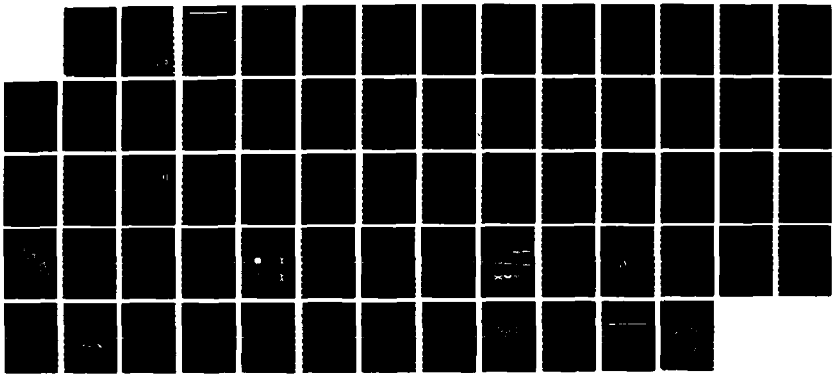

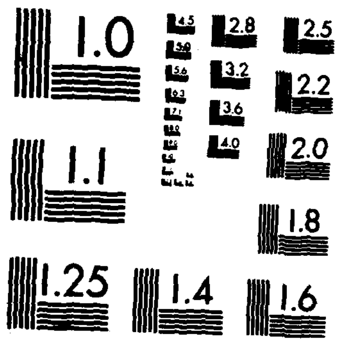

!CROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

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David W. Taylor Naval Ship Research and Development Center

Bethesda, MD 20084-5000

CMLD-86-18 May 1986

Computation, Mathematics & Logistics

Departmental

GUIDE TO USING DISPLAY INTEGRATED SOFTWARE SYSTEM AND PLOTTING LANGUAGE (DISSPLA)

KEVIN G. BRADY

CMLD-86-18 Guide To Using Display Integrated Software System and Plotting Language (DISSPLA)

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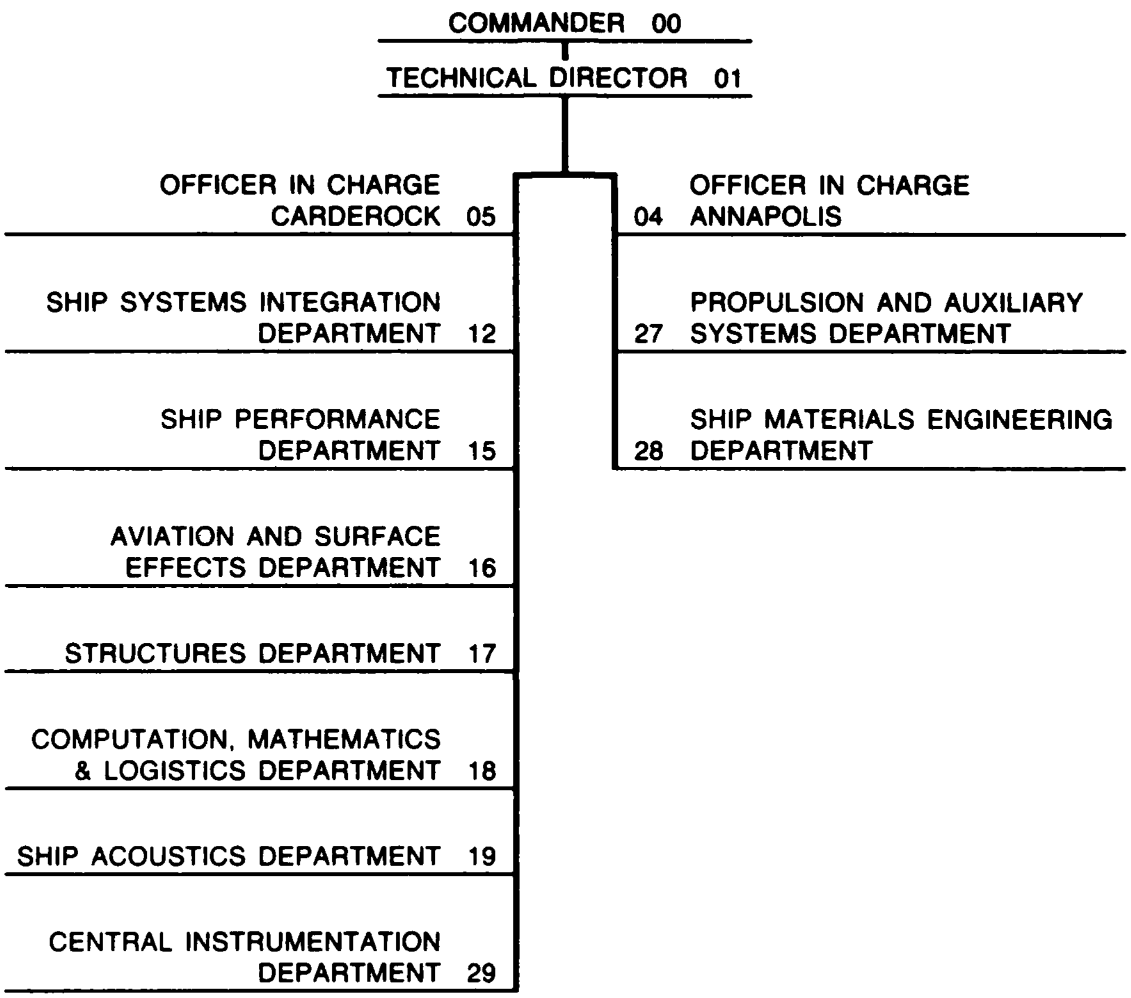
MAJOR DTNSRDC TECHNICAL COMPONENTS


COMMANDER 00
TECHNICAL DIRECTOR 01
OFFICER IN CHARGE CARDEROCK 05
SHIP SYSTEMS INTEGRATION DEPARTMENT 12
SHIP PERFORMANCE DEPARTMENT 15
AVIATION AND SURFACE EFFECTS DEPARTMENT 16
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28 SHIP MATERIALS ENGINEERING DEPARTMENT

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This document contains a brief discussion and examples using Display Integrated Software System and Plotting Language (DISSPLA) at Central Computer Facility.

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Table of Contents

Introduction

This document is intended to give the user a basic understanding of Display Integrated Software System and Plotting Language. All examples were taken from implementations at David Taylor Naval Ship R & D Center to show actual scientific uses. All examples were run, unless specifically stated, on the VAXcluster using version 9.2 of DISSPLA. This version will soon be available on the CYBERs and aside from certain machine dependencies, all examples will then run on the CYBERs. In interactive examples, underlined commands are typed by the user.

Conventions

Throughout this document the following argument naming conventions hold:

ARGUMENTS:

X, IX, LX	- Refer to the X-axis
Y, IY, LY	- Refer to the Y-axis
I, J, K, M, N	- Integer Values
All Others	- Real Values
L____	- String of text
___RAY	- Array of values

NOTATION:

{...}	- Within a program listing are comments
(underline) ______	- In examples are user type-ins
p/s	- parameter setting

Devices

The call to a device MUST be the first call in a DISSPLA program. The following devices are currently active; Other devices may be activated at the user's request, these calls are supported by version 9.2 which is currently only on the VAXcluster and should soon be on the CYBERs.

Tektronix 4000 Series:

```
CALL TK4006 ( icps )
CALL TK4010 ( icps )
CALL TK4012 ( icps )
CALL TK4013 ( icps )
CALL TK4014 ( icps, idevc )
CALL TK4015 ( icps, idevc )
CALL TK4016 ( icps, idevc )
CALL TK4025
CALL TK4027
CALL TK4051 ( icps )
CALL TK4052 ( icps )
CALL TK4054 ( icps, idevc )

CALL TEKALL ( imodel, icps, 0, idevc, 0 )

CALL PTEKAL     { will prompt for all information }

icps - Baud rate (30, 120, 240, 480, 960)

idevc - is 1 for high resolution (4096)
      - is 0 for low resolution (1024)
```

Tektronix 4100 Series:

```
CALL TK41 ( IMODEL )

IMODEL - 4105, 4107, 4109, 4112, 4113, 4114, 4115, 4116

CALL PTK41    { will prompt for model number }
```

DEC Terminals:

```
CALL REGIS ( ioptin, idevc )

ioptin - 1 (    VT125     )
       - 2 (    VK100     )
       - 3 ( VT240, VT241 )
       - 4 ( DEC PRO 350  )

idevc - 0 (Monochrome Monitor)
      - 1 (Color Monitor     )

CALL PREGIS     {will prompt for information}
```

CALCOMP:

```
CALL CALCOMP (0, 0, 10)
```

The file CALCOMPOUT.DAT is created for processing to tape using the procedure VSYS:CALCD2T on the VAX.

The file TAPE10 is created for processing to tape on either of the CYBERs.

META FILE:

```
CALL COMPRS
```

The file DISPLOT.DAT is created for processing by the Post-Processor on the VAX. (RUN VSYS:DISPOP)

The file PLFILE is created for processing by the Post-Processor on either of the CYBERs. (DISPOST)

<u>Illegal Unit Numbers</u>

Unit Numbers used by DISSPLA which <u>CANNOT</u> be used in your program:

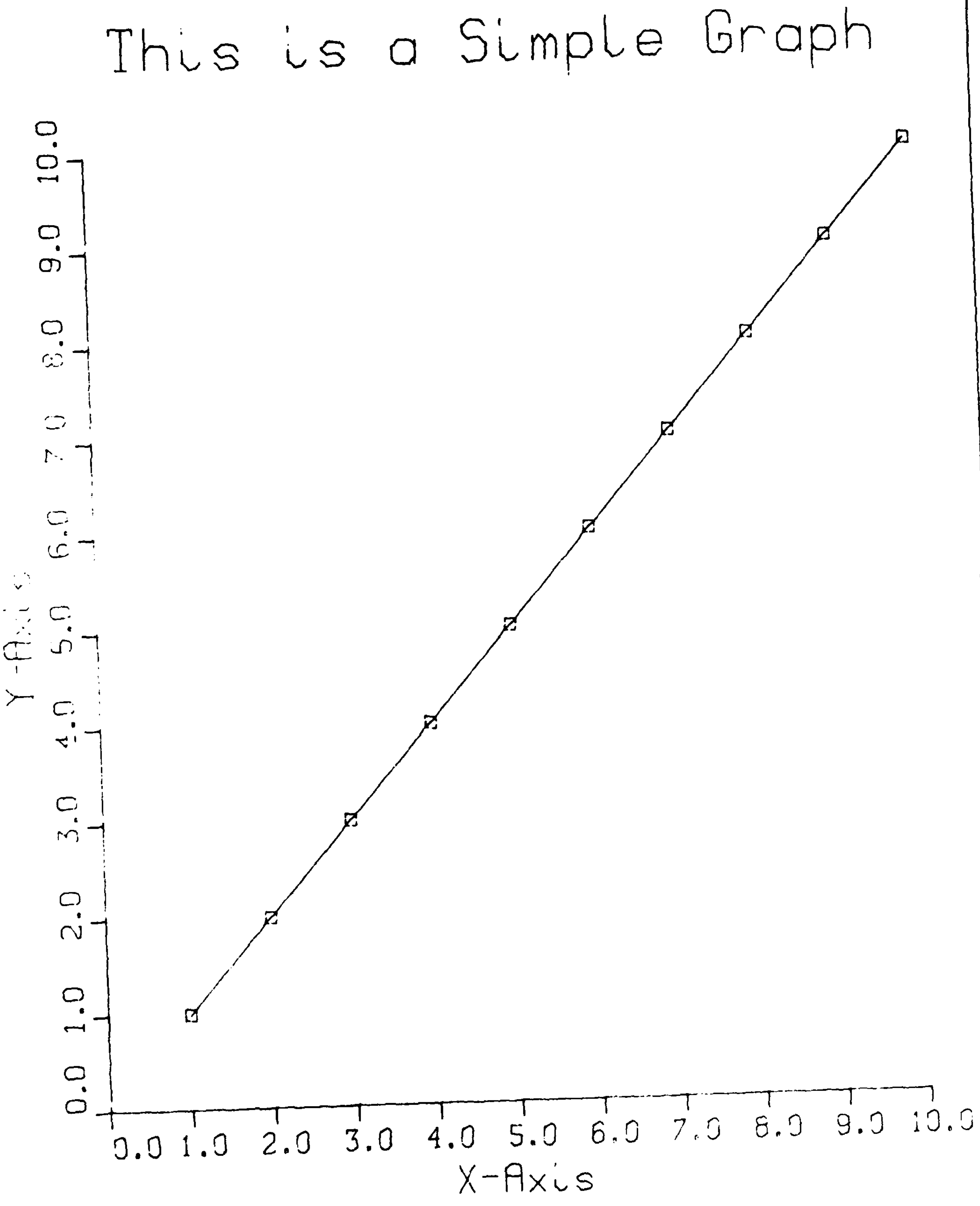
31,32,33	Scratch files
90,91,93	Mapping and Landblanking
95	META file for COMPRS
96	Font files
97	Scratch file
10	CALCOMP file

This is an example of running a DISSPLA program on the VAXcluster.

```
      PROGRAM EXAMPLE1          { This example is for the VAX }
      DIMENSION X(10), Y(10)
      DATA Y /1, 2, 3, 4, 5, 6, 7, 8, 9, 10/
      DATA X /1, 2, 3, 4, 5, 6, 7, 8, 9, 10/
      CALL COMPRS
      CALL BGNPL  (0)
      CALL TITLE  ('This is a Simple Graph$', 100, 'X-Axis$', 100,
     .             'Y-Axis$', 100, 6., 8.)
      CALL GRAF   (0., 1., 10., 0., 1., 10.)
      CALL CURVE  (X, Y, 10, 1)
      CALL ENDPL  (0)
      CALL DONEPL
      END
```

```
$ fortran myfile
$ dislink myfile
Other Libraries (y or n): n
$ run myfile

                    PLOTTING COMMENCING
                    ...................

NO. OF FIRST PLOT  0


END OF DISSPLA 9.2 -- 894 VECTORS IN 1 PLOTS.
RUN ON 1/17/86 USING SERIAL NUMBER 3105 AT  DTNSRDC VAX
PROPRIETARY SOFTWARE PRODUCT OF ISSCO, SAN DIEGO, CA.
403 VIRTUAL STORAGE REFERENCES; 5 READS; 0 WRITES.
$ run vsys:dispop
ENTER DEVICE TYPE.....

1=TEK 40xx, 2=CALCOMP 1051, 3=TEK 41xx, 4=REGIS (VT240), 5=PRINTER PLOT

3
ENTER MODEL NUMBER                       { Enter your device }
4105
 ENTER POST-PROCESSOR DIRECTIVES
<CR>
 PLOT FILE GENERATED BY Kevin Brady
                    AT  DTNSRDC VAX
                    ON JAN 17, 1986   8:46
```

__Example 1__


This is a Simple Graph
Y-Axis
X-Axis
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0

This command procedure on the VAXcluster will do the entire process with no user interaction:

```
$ on error then exit
$ again:
$ if pl .eqs. "" then inquire pl "Filename"
$      ! Keep prompting for filename
$ if pl .eqs. "" then goto again
$ fortran 'pl'
$      ! libraries linked twice because of nowrap search
$ link 'pl',vsys:disintf/library,disspla/library,-
                disintf/library,disspla/library
$ run 'pl'
$ run vsys:dispop
3
4105                { This line must be changed to your device }

$ exit
```

The same program run interactively on either of the CYBERs to create a CALCOMP plot :

```
        PROGRAM EXAMPLE1
        DIMENSION X(10), Y(10)
        DATA Y /1, 2, 3, 4, 5, 6, 7, 8, 9, 10/
        DATA X /1, 2, 3, 4, 5, 6, 7, 8, 9, 10/
        CALL COMPRS
        CALL BGNPL  (0)
        CALL HEIGHT (0.2)
        CALL TITLE  ("THIS IS A SIMPLE GRAPH", 22, "X-AXIS", 6
       .             "Y-AXIS", 6, 6., 8.)
        CALL GRAF   (0., 1., 10., 0., 1., 10.)
        CALL CURVE  (X, Y, 10, 1)
        CALL ENDPL  (0)                       {Double quotes are }
        CALL DONEP                            {required on CYBERs}
        END
```

```
COMMAND-CONNECT,OUTPUT
COMMAND-ATTACH,INFILE,MYPLOT,ID=CAKB
          AT CY= 001 SN=SYSSET
COMMAND-ATTACH,DISSPLA
          PFN IS  DISSPLA
          AT CY= 006 SN=SYSSET1
COMMAND-REQUEST,TAPE10,*PF
COMMAND-ATTACH,NSRDC
          PFN IS  NSRDC
          AT CY= 105 SN=SYSSET1
COMMAND-LIBRARY,DISSPLA,NSRDC
COMMAND-FTN5,I=INFILE,L=0
               56100 CM STORAGE USED.
               0.020 CP SECONDS COMPILATION TIME.
COMMAND-LGO

                     PLOTTING COMMENCING
                     ...................

 ..... DISSPLA VERSION 8.2 .....
 NO. OF FIRST PLOT  0



 END OF DISSPLA 8.2 --       897 VECTORS GENERATED IN      1 PLOT FRAMES.
 -ISSCO-  4186 SORRENTO VALLEY BLVD.,SAN DIEGO CALIF. 92121

 DISSPLA IS A CONFIDENTIAL PROPRIETARY PRODUCT OF ISSCO AND ITS USE
    IS SUBJECT TO A NONDISSEMINATION AND NONDISCLOSURE AGREEMENT.
               NON-FATAL LOADER ERRORS - SEE MAP
               END  PLOTIT
               61300 MAXIMUM EXECUTION FL.
               0.132 CP SECONDS EXECUTION TIME.
```

```
COMMAND-RETURN,DISSPLA,NSRDC
COMMAND-ATTACH,DISPOST
          PFN IS  DISPOST
          AT CY= 007 SN=SYSSET1
COMMAND-LIBRARY,DISPOST
COMMAND-POP936

* * * * * * * * * *  CALCOMP POST-PROCESSOR  * * * * * * * * * *
 INPUT DIRECTIVES                    { Input space then <CR> }


          PLOT FILE GENERATED BY CAKBOE2     AT 10.05.27  ON 01/17/86
1 THE NUMBER OF CALCOMP BLOCKS IN THIS FILE IS        3
             1 PLOTS HAVE BEEN PROCESSED

 ......................... END OF POSTPROCESSOR ..........................
             END  POP936
COMMAND-CATALOG,TAPE10,ID=CAKB
          NEWCYCLE CATALOG
          RP = 030 DAYS
          CT ID=     CAKB PFN=TAPE10
          CT CY= 002  00000016 PRUS  $0000.04 /DAY
          CT SN=  SYSSET
COMMAND-
```

The following procedure, stored in the user's permanent file PLOTIT, will let him view his output on a Tektronix terminal:

```
.PROC,PLOTIT.
ATTACH,INFILE,MYPLOT,ID=CAKB.
ATTACH,DISSPLA.
REQUEST,PLFILE,*PF.
ATTACH,NSRDC.
LIBRARY,DISSPLA,NSRDC.
FTN5,I=INFILE,L=0.
LGO.
CATALOG,PLFILE,ID=CAKB.
RETURN,DISSPLA,NSRDC.
ATTACH,DISPOST.
LIBRARY,DISPOST.
TEK300.
REVERT.
```

To execute type:

```
COMMAND-ATTACH,PLOTIT,ID=xxxx

COMMAND-PLOTIT
```

NOTE: Currently on the CYBERs there are two versions of the Tektronix post-processor, the one attached above is used for color plots and WILL NOT stop between plots if there are more than one. To view multiple plots with a pause between each one, the other version of the post processor must be used. Instead of the "ATTACH,DISPOST" and "LIBRARY,DISPOST", MSFETCH the file TEK300 ("MSFETCH,TEK300,UN=CSYS") and continue.

Level Structure

The axis system cannot be drawn until the sub-plot area and physical origin are defined. Similarly, curves cannot be drawn until the axis system is established. Thus, DISSPLA has a level structure to ensure that all necessary information is present during the construction of a plot. An error message is printed if a routine is called at the wrong level.

The DISSPLA levels are:

0 - before device initialization

1 - after device initialization

2 - after page border, physical origin, and subplot area defined

3 - after axis system is defined

Subroutine	Level at call	Level after call
CALL DEVICE	0	1
CALL AREA2D (XAXIS, YAXIS)	1	2
CALL XNAME (LXNAME, YXNAME)	2	p/s
CALL YNAME (LYNAME, IYNAME)	2	p/s
CALL HEADIN (LHEAD, IHEAD, HTMULT, NLINES)	2,3	same
CALL GRAF (XORG, XSTP, XMAX, YORG, YSTP, YMAX)	2	3
CALL CURVE (XARAY, YARRAY, NPTS, IMARK)	3	same
CALL ENDPL (IPLOT)	2,3	1
CALL DONEPL	1	0

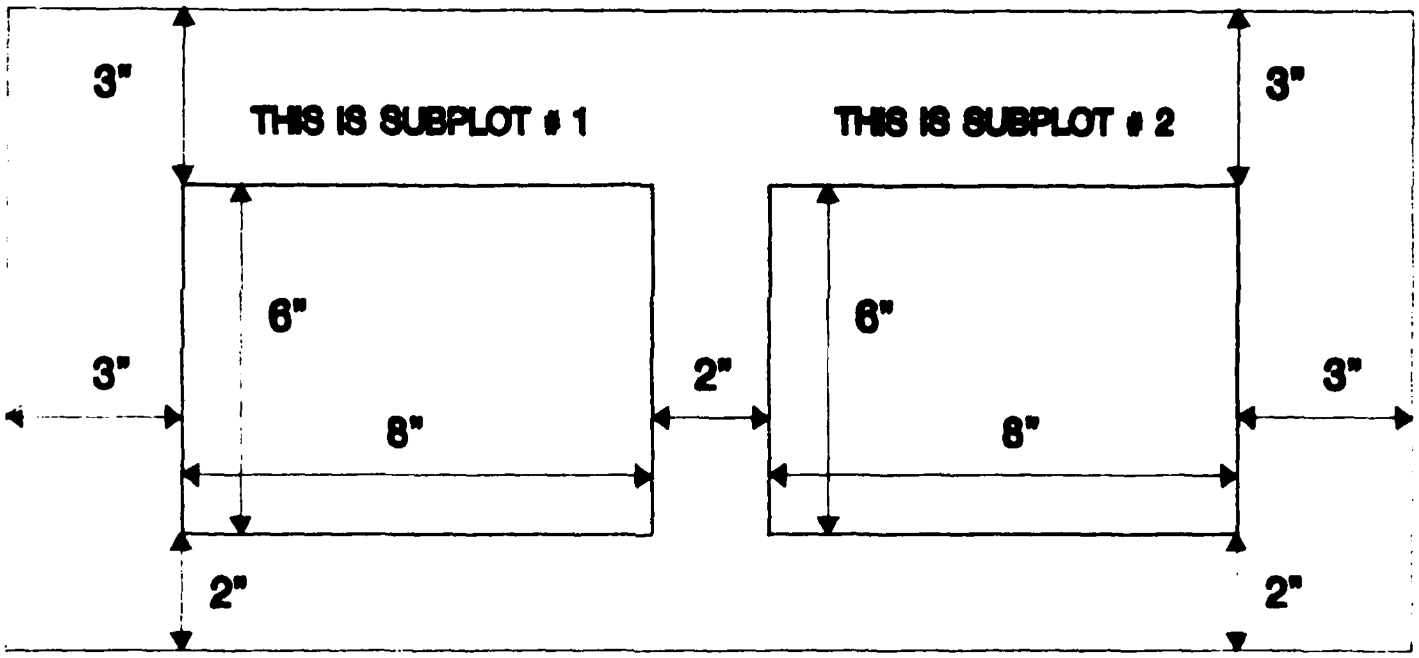
Subroutine	Level at call	Level after call
To change page size from 8.5 x 11 inch default:		
CALL PAGE (XPAGE, YPAGE)	1	p/s
To position the physical origin:		
CALL PHYSOR (XPHYS, YPHYS)	1	p/s
To re-position the origin relative to PHYSOR:		
CALL OREL (XOREL, YOREL)	1	p/s
To end the plot and remain on same page:		
CALL ENDGR (IPLOT)	2,3	1
To frame the subplot area:		
CALL FRAME	2,3	same

To understand the concept of setting up the plot, consider the following example. The page will be set to 24" X 11", and will contain two subplots. The lower left corner of the first plot is positioned at the point (3",2") by PHYSOR. AREA2D then sets the current plotting area to 8" X 6". Now the plotting can begin (although no plots are actually done in this example). The first plot is then ended by ENDGR, which tells DISSPLA you are done with the first plot but will remain on the same page to do another plot. The lower left corner of the second plot is then put at (13",2") by OREL (moved relative to previous origin). AREA2D is called again to define the second plot area, and plotting could commence. This plot is ended by ENDGR again then ENDPL terminates the plot on this page.

```
PROGRAM EXAMPLE2
CALL COMPRS                          { Level 0 to Level 1 }
CALL BGNPL (0)
CALL PAGE (24., 11.)
CALL PHYSOR (3., 2.)
CALL AREA2D (8., 6.)                 { Level 1 to Level 2 }
CALL FRAME
CALL HEADIN ('THIS IS SUBPLOT # 1$', 100, 3., 1)
CALL ENDGR (0)                       { Level 2 to Level 1 }
CALL OREL (10., 0.)
CALL AREA2D (8., 6.)                 { Level 1 to Level 2 }
CALL FRAME
CALL HEADIN ('THIS IS SUBPLOT # 2$', 100, 3., 1)
CALL ENDGR (0)                       { Level 2 to Level 1 }
CALL DONEPL                          { Level 1 to Level 0 }
END
```

<u>NOTE</u>: Programs are for VAXcluster only!

Example 2



Two Dimensional Graphing

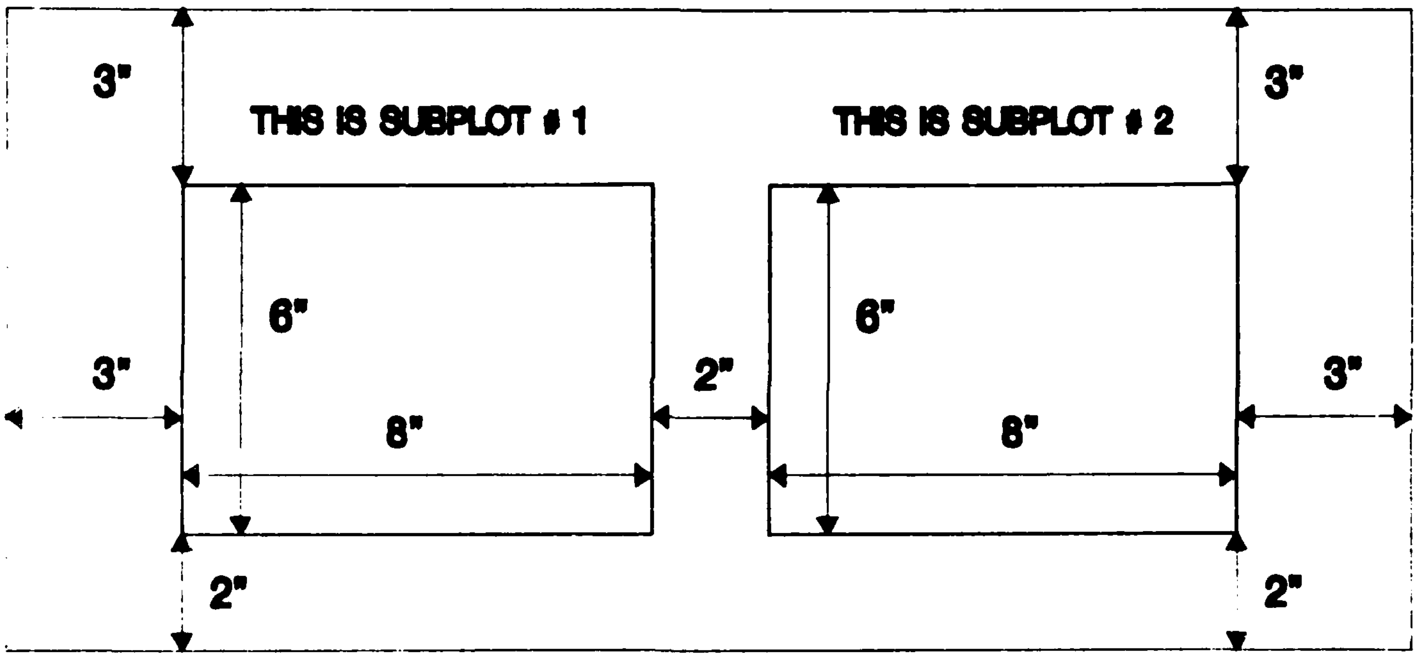
Once the subplot area has been defined, the next step is to define the axis system. Below are some of the major routines, refer to the User's Manual for a more complete description.

Subroutine	Level at call	Level after call
Primary graph setup routines:		
CALL GRAF (XORG, XSTP, XMX, YORG, YSTP, YMX)	2	3
CALL XLOG (XORIG, XCYCLE, YORIG, YSTEP)	2	3
CALL YLOG (XORIG, XSTEP, YORIG, YSTEP)	2	3
CALL LOGLOG (XORIG, XCYCLE, YORIG, YCYCLE)	2	3
CALL POLAR (THEFAC, RSTEP, XDIST, YDIST)	2	3
CALL GRID (IXGRID, IYGRID)	3	Same
To position messages in <u>INCHES</u>:		
CALL MESSAG (LMESS, IMESS, XPOS, YPOS)	2,3	Same
CALL REALNO (ANUM, IPLACE, XPOS, YPOS)	2,3	Same
CALL INTNO (INUM, XPOS, YPOS)	2,3	Same
CALL VECTOR (XFROM, YFROM, XTO, YTO, IVEC)	2,3	Same
To position messages in <u>DATA</u> units:		
CALL RLMESS (LMESS, IMESS, XVAL, YVAL)	3	Same
CALL RLREAL (ANUM, IPLACE, XVAL, YVAL)	3	Same
CALL RLINT (INUM, XVAL, YVAL)	3	Same
CALL RLVEC (XFROM, YFROM, XTO, YTO, IVEC)	3	Same

Now let us reconsider example #2 as it actually appeared when ran. Example #3 is the same program with the sequence of commands used to draw the vectors (with arrowheads) and the integer distances included. It is actually three plots (the first two are the subplots, the third is the entire page) so that the vectors can be placed around the subplot areas but not off of the page. First the vector is drawn (in inches from the origin), then INTNO places the value currently into the variable INUM (integer) at the coordinates specified (in inches from the origin). Then MESSAG is called to place the inch symbol (notice that 'ABUT' is used for both coordinates) directly after the previous symbol it just wrote, in this case directly after what INTNO wrote.

```
PROGRAM EXAMPLE3
CALL COMPRS
CALL BGNPL (0)
CALL PAGE (24., 11.)
CALL PHYSOR (3., 2.)
CALL AREA2D (8., 6.)
CALL FRAME
CALL HEADIN('THIS IS SUBPLOT # 1$'
,100, 3., 1.)
CALL ENDGR (0)
CALL OREL (10., 0.)
CALL AREA2D (8., 6.)
CALL FRAME
CALL HEADIN('THIS IS SUBPLOT # 2$'
,100, 3., 1.)
CALL ENDGR (0)
CALL PHYSOR (0., 0.)
CALL AREA2D (20., 11.)
CALL HEIGHT (.5)
CALL SETCLR ('RED')
CALL VECTOR (3., 0., 3., 2., 3402)
INUM=2
CALL INTNO (INUM, 3.5, .75)
CALL MESSAG ('"',2,'ABUT','ABUT')
CALL VECTOR (0., 4., 3., 4., 3402)
INUM=3
CALL INTNO (INUM, 1.5, 4.5)
CALL MESSAG ('"',2,'ABUT','ABUT')
CALL VECTOR (3., 8., 3., 11.,3402)
INUM=3
CALL INTNO (INUM, 1.5, 9.5)
CALL MESSAG ('"',2,'ABUT','ABUT')
CALL VECTOR (3., 3., 11., 3.,3402)
INUM=8
CALL INTNO (INUM, 6.5, 3.5)
CALL MESSAG ('"', 2, 'ABUT', 'ABUT')
CALL VECTOR(4.,2.,4.,8.,3402)
INUM=6
CALL INTNO(INUM,4.5,5.5)
CALL MESSAG('"',2,'ABUT','ABUT')
CALL VECTOR(11.,4.,13.,4.,3402)
INUM=2
CALL INTNO(INUM,11.75,4.5)
CALL MESSAG('"',2,'ABUT','ABUT')

CALL VECTOR(14.,2.,14.,8.,3402)
INUM=6
CALL INTNO(INUM,14.5,5.5)
CALL MESSAG('"',2,'ABUT','ABUT')
CALL VECTOR(13.,3.,21.,3.,3402)

INUM=8
CALL INTNO(INUM,14.5,5.5)
CALL MESSAG('"',2,'ABUT','ABUT')
CALL VECTOR(21.,0.,21.,2.,3402)
INUM=2
CALL INTNO(INUM,21.5,.75)
CALL MESSAG('"',2,'ABUT','ABUT')
CALL VECTOR(21.,8.,21.,11.,3402)
INUM=3
CALL INTNO(INUM,21.5,9.5)
CALL MESSAG('"',2,'ABUT','ABUT')
CALL VECTOR(21.,4.,24.,4.,3402)
INUM=3
CALL INTNO(INUM,22.5,4.5)
CALL MESSAG('"',2,'ABUT','ABUT')
CALL ENDPL(0)
CALL DONEPL
END
```

Example 3



Once DISSPLA is in level 3, plotting of curves may begin. The call to CURVE may be made as many times as needed.

Subroutine	Level at call	Level after call
To draw a curve:		
CALL CURVE (XARAY, YARAY, NPTS, IMARK)	3	Same

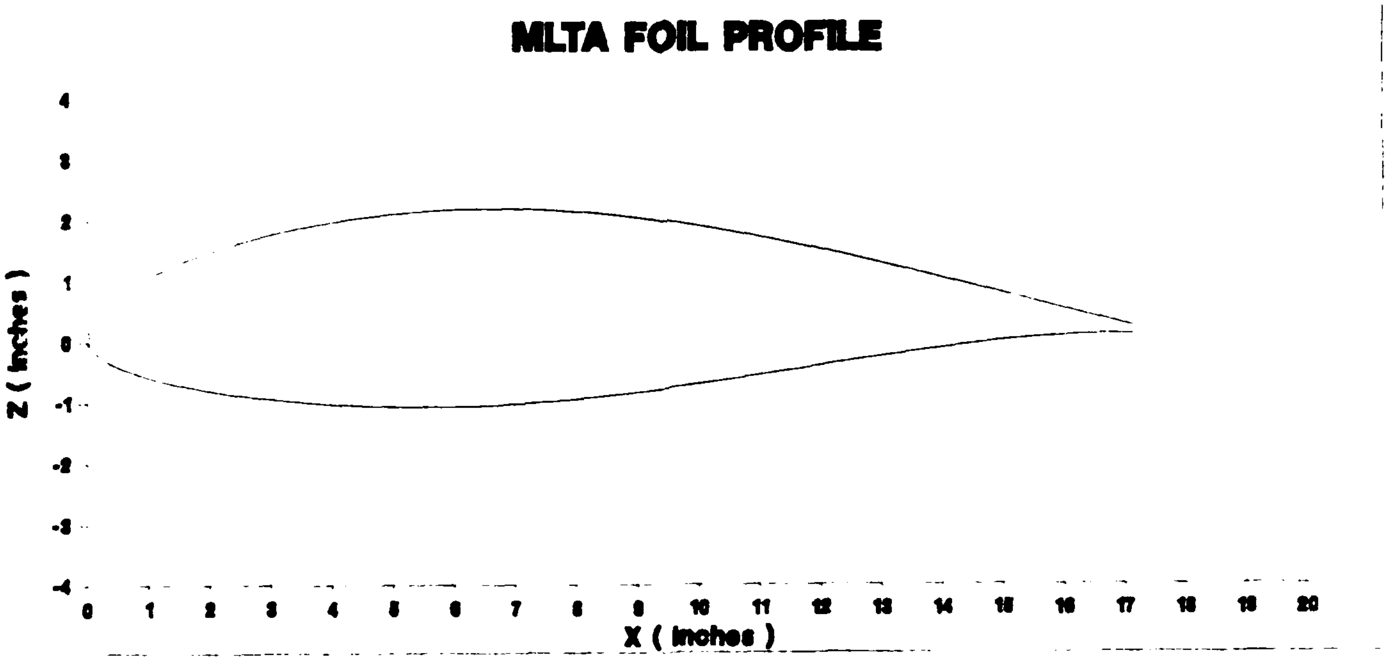
```
XARAY - array of X values
YARAY - array of Y values
 NPTS - number of points to plot
IMARK - < 0 symbols every Ith point, not connected
        = 0 points connected, no symbols
        > 0 symbols every Ith mark, connected
```

Subroutine	Level at call	Level after call
To blank an area around the curve:		
CALL BLCURV (OFWDTH, OFLNTH)	1,2,3	p/s
To thicken curves:		
CALL THKCRV (THKNSS)	1,2,3	p/s
To change the grace margin of subplot:		
CALL GRACE (GRACEM)	1,2,3	p/s
To select a marker:		
CALL MARKER (ISYM)	1,2,3	p/s
To blank symbol markers:		
CALL BLSYM	1,2,3	p/s
To change size of markers:		
CALL SCLPIC (FACTOR)	1,2,3	p/s

This example reads data points into two arrays, then plots the curve. This object must be drawn to scale, so PAGE is set to 23" X 11". AREA2D then sets the plot size to 20" X 8" (from within TITLE). SETDEV directs error messages and summary messages to unit # 3 (FOR003.DAT on the VAXcluster; TAPE# on the CYBERs), so that they will not appear on the screen and a hardcopy is kept. INTAXS will print only the integer values along the axes, and YAXANG will write the values along the Y axis horizontally. GRAF sets up the scale of the axes, the X axis will run from 0 to 20 by steps of 1, the Y axis will run from -4 to +4 by steps of 1. CURVE is then called twice, once to plot the upper portion, and the second time to plot the lower portion.

```
        PROGRAM EXAMPLE4

        DIMENSION X(10000),Y(10000)
        OPEN(1,FILE='FOR001.DAT',STATUS='OLD')
        OPEN(2,FILE='FOR002.DAT',STATUS='OLD')

        CALL COMPRS                              { Level 0 to Level 1 }

        CALL BGNPL  (0)

        CALL SETDEV (3, 3)

        CALL SETCLR ('BLUE')

        CALL PAGE   (23.0, 11.0)

        CALL HEIGHT (.3)

        CALL SWISSB

        CALL SHDCHR (90., 1, .002, 1)

        CALL INTAXS

        CALL YAXANG (0.)

        CALL TITLE  ('MLTA FOIL PROFILES$', 100, 'X ( INCHES )$',
      . 100, 'Z ( INCHES )$', 100, 20., 8.) { Level 1 to Level 2 }

        CALL GRAF   (0., 1., 20., -4., 1., 4.)
                                                 { Level 2 to Level 3 }
        CALL SETCLR ('RED')

        DO 20 I=1,10000

          READ(1,'(E15.5,3X,E15.5)',END=21)X(I),Y(I)

 20     CONTINUE

 21     CALL CURVE (X, Y, 9500, 0)

        DO 30 I=1,10000

          READ(2,'(E15.5,3X,F15.5)',END=32)X(I),Y(I)

 30     CONTINUE

 32     CALL CURVE (X, Y, 9500, 0)

        CALL ENDPL (0)                             { Level 3 to Level 1 }
        CALL DONEPL                                { Level 1 to Level 0 }
        END
```

Example 4


MLTA FOIL PROFILE
Z (inches)
X (inches)
4
3
2
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Legends and Stories

. To draw a Legend for your graph, or write out a block of text(Story), use one of the following routines.

Subroutine	Level at call	Level after call
To store lines of text:		
CALL LINES (LSTRING, IPKARAY, ILINE)	1,2,3	Same
To draw a legend:		
CALL LEGEND (IPKARAY, NLINES, XPOS, YPOS)	1,2,3	Same
To initialize IPKARAY and set J to max lines possible in Legend:		
J = LINEST (IPKRAY, NPKWRD, IMAX)	1,2,3	Same
To write a block of centered text:		
CALL STORY (IPKARAY, NLINES, XPOS, YPOS)	1,2,3	Same
To left justify a block of text:		
CALL LSTORY (IPKARAY, NLINES, XPOS, YPOS)	1,2,3	Same
To right justify a block of text:		
CALL RSTORY (IPKARAY, NLINES, XPOS, YPOS)	1,2,3	Same
To get the size of LEGEND:		
XLEN = XLEGEND (IPK, NLINES)	1,2,3	Same
YLEN = YLEGEND (IPK, NLINES)	1,2,3	Same
To get the size of STORY:		
XLEN = XSTORY (IPK, NLINES)	1,2,3	Same
YLEN = YSTORY (IPK, NLINES)	1,2,3	Same

To get the length of messages:

XLEN = XMESS (LMESS, IMESS)		1,2,3	Same

To get the length of numbers:

XLEN = XREAL (ANUM, IPLACE)	{ REALS }	1,2,3	Same
XLEN = XINT (INT)	{INTEGER}	1,2,3	Same

To get X,Y position in inches of a data point:

A = XPOSN (XVAL, YVAL)	1,2,3	Same
B = YPOSN (XVAL, YVAL)	1,2,3	Same

To get X,Y coordinate values:

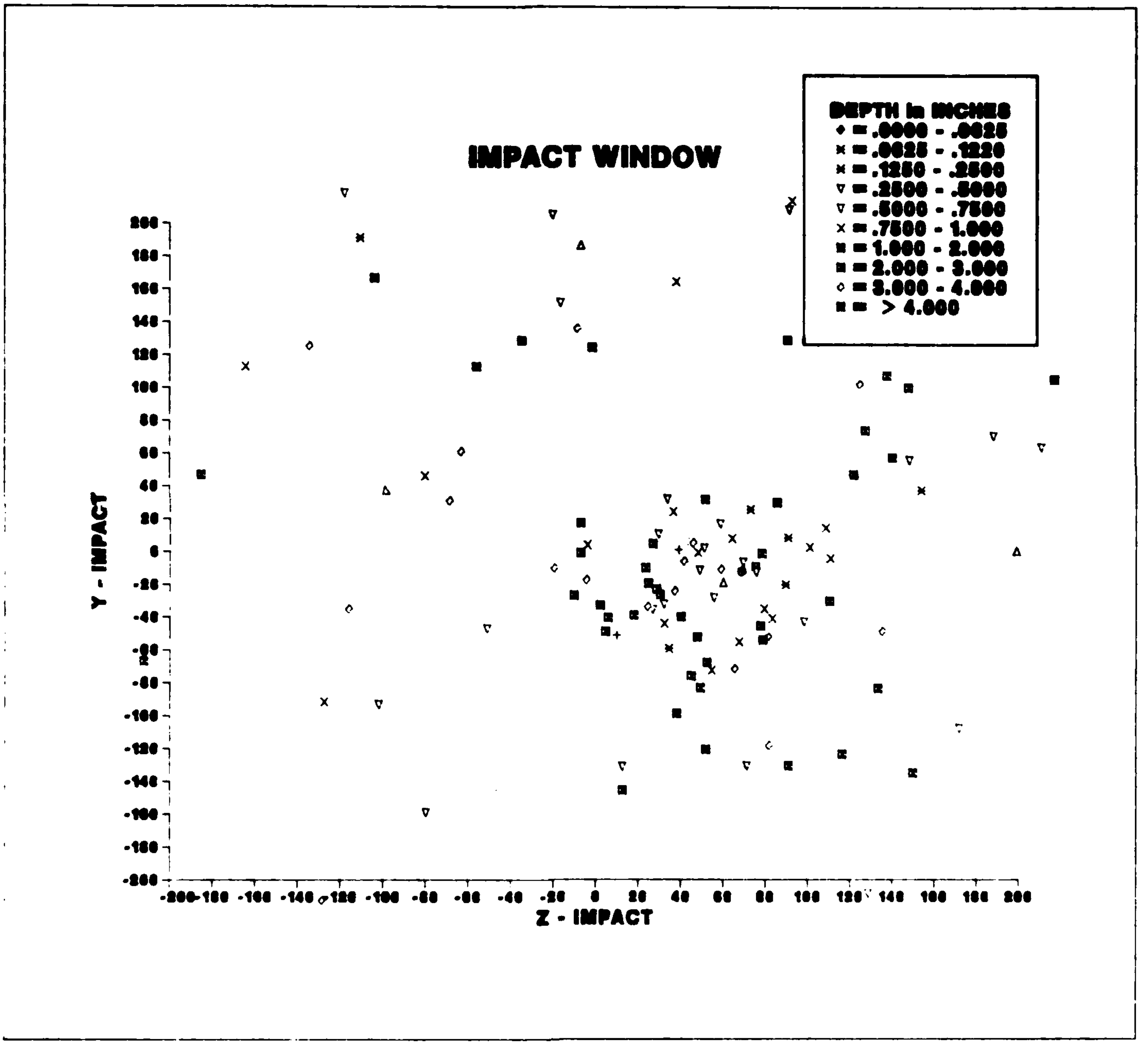
A = XINVRS (XINCH, YINCH)	1,2,3	Same
B = YINVRS (XINCH, YINCH)	1,2,3	Same

The next example uses a legend containing 9 lines which are packed by LINES and stored. MYLEGN changes the title on the legend to any string. BLREC uses the values of XLEGEND and YLEGEND to blank out the area where the legend will be written, to prevent curves from over writing it. Notice that LEGLIN is called directly before CURVE, the line type is stored with the legend titles. NOTE: the curves must be called in the same order as they appear in the legend. LEGEND then prints out the legend at the specified coordinates.

The second example is basically the same except SPCMOD is called. This subroutine calls MYSPEC and also stores the color of the line that was used.

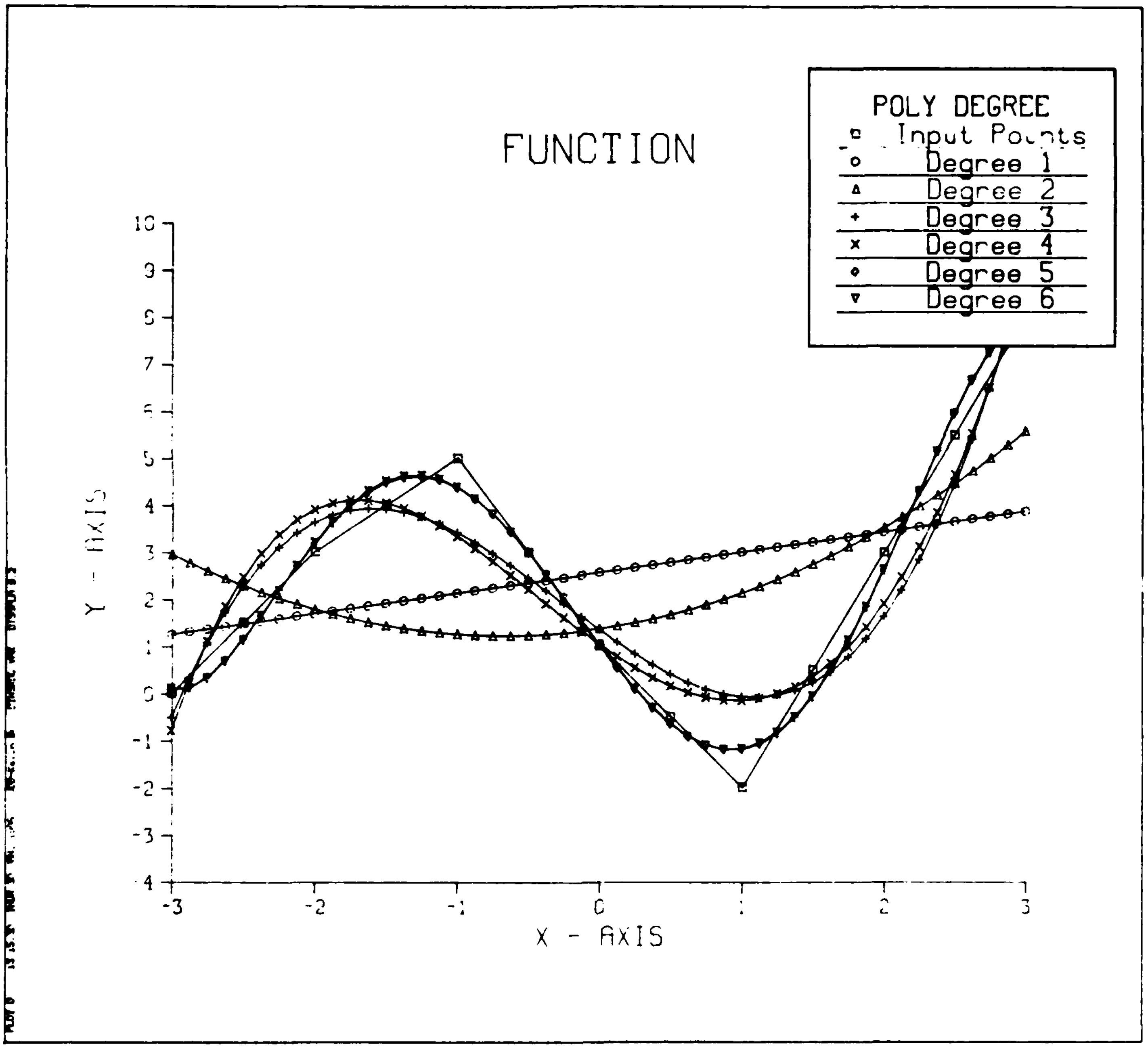
```
      PROGRAM EXAMPLE5
      DIMENSION IPAK(10000),Y(10),Z(10)
      OPEN(1,FILE='JETDATA',STATUS='OLD')
      CALL COMPRS
      CALL BGNPL  (0)
      CALL SETDEV (2, 2)
      CALL SETCLR ('BLUE')
      CALL PAGE   (12.0, 11.0)
      CALL SWISSB
      CALL INTAXS
      CALL YAXANG (0.)
      CALL SHDCHR (90., 1, .002, 1)
      CALL TITLE  ('IMPACT WINDOW$', 100, 'Z - IMPACT$', 100,
     . 'Y - IMPACT$', 100, 9., 7.)
      CALL GRAF   (-200., 20., 200., -200., 20., 200.)
      CALL SETCLR ('RED')
      CALL LINES  ('.0000 - .0625$', IPAK, 1)
      CALL LINES  ('.0625 - .1220$', IPAK, 2)
      CALL LINES  ('.1250 - .2500$', IPAK, 3)
      CALL LINES  ('.2500 - .5000$', IPAK, 4)
      CALL LINES  ('.5000 - .7500$', IPAK, 5)
      CALL LINES  ('.7500 - 1.000$', IPAK, 6)
      CALL LINES  ('1.000 - 2.000$', IPAK, 7)
      CALL LINES  ('2.000 - 3.000$', IPAK, 8)
      CALL LINES  ('3.000 - 4.000$', IPAK, 9)
      CALL LINES  (' > 4.000$', IPAK, 10)
      CALL MYLEGN ('DEPTH IN INCHES$', 100)
      XR = XLEGND (IPAK, 10) + .3
      YR = YLEGND (IPAK, 10) + .3
      CALL BLREC  (7.-.3, 6.-.3, XR+.3, YR+.3, .02)
      DO 20 I=1,500
        READ(1,'(70X,F5.2,2X,F9.2,2X,F9.2)',END=32)DEP,Y(1),Z(1)
        IF((DEP.GE.0.0   ) .AND. (DEP.LT.0.0625)) CALL MARKER(1)
        IF((DEP.GE.0.0625) .AND. (DEP.LT.0.1250)) CALL MARKER(2)
        IF((DEP.GE.0.1250) .AND. (DEP.LT.0.2500)) CALL MARKER(3)
        IF((DEP.GE.0.25  ) .AND. (DEP.LT.0.5000)) CALL MARKER(4)
        IF((DEP.GE.0.5   ) .AND. (DEP.LT.0.750 )) CALL MARKER(5)
        IF((DEP.GE.0.75  ) .AND. (DEP.LT.1.0   )) CALL MARKER(6)
        IF((DEP.GE.1.0   ) .AND. (DEP.LT.2.0   )) CALL MARKER(7)
        IF((DEP.GE.2.0   ) .AND. (DEP.LT.3.0   )) CALL MARKER(8)
        IF((DEP.GE.3.0   ) .AND. (DEP.LT.4.0   )) CALL MARKER(9)
        IF((DEP.GE.4.0)  ) CALL MARKER(10)
        CALL LEGLIN
        CALL CURVE (Y, Z, 1, -1)
20    CONTINUE
32    CALL RESET   ('BLNKS')
      CALL LEGEND  (IPAK, 10, 7., 6.)
      CALL ENDPL   (0)
      CALL DONEPL
      END
```

Example 5


IMPACT WINDOW
DEPTH in INCHES
◆ = .0000 - .0625
× = .0625 - .1220
× = .1250 - .2500
▽ = .2500 - .5000
▽ = .5000 - .7500
× = .7500 - 1.000
■ = 1.000 - 2.000
■ = 2.000 - 3.000
◇ = 3.000 - 4.000
■ = > 4.000
Y - IMPACT
Z - IMPACT
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
-200
-180
-160
-140
-120
-100
-80
-60
-40
-20
0
20
40
60
80
100
120
140
160
180
200

```
      PROGRAM EXAMPLE6
      DIMENSION X(50),Y(50),IPAK(1000)
      OPEN (1,FILE='DAT',STATUS='OLD')
      CALL COMPRS
      CALL BGNPL  (0)
      CALL SETCLR ('BLUE')
      CALL HEIGHT (.2)
      CALL PAGE   (12.0, 11.0)
      CALL INTAXS
      CALL YAXANG (0.)
      CALL TITLE  ('FUNCTION$', 100, 'X - AXIS$', 100,
     .'Y - AXIS$', 100, 9., 7.)
      CALL SETCLR ('GREEN')
      CALL GRAF   (-3., 1., 3., -4., 1., 10.)
      CALL SETCLR ('GREEN')
      CALL LINES  ('INPUT POINTS$', IPAK, 1)
      CALL LINES  ('  DEGREE 1  $', IPAK, 2)
      CALL LINES  ('  DEGREE 2  $', IPAK, 3)
      CALL LINES  ('  DEGREE 3  $', IPAK, 4)
      CALL LINES  ('  DEGREE 4  $', IPAK, 5)
      CALL LINES  ('  DEGREE 5  $', IPAK, 6)
      CALL LINES  ('  DEGREE 6  $', IPAK, 7)
      CALL MYLEGN ('POLY DEGREE$', 100)
      XR = XLEGND (IPAK, 7) + .3
      YR = YLEGND (IPAK, 7) + .3
      CALL BLREC  (7.-.3, 6.-.3, XR+.3, YR+.3, .02)
      DO 10 I=1,13
       READ(1,*)X(I),Y(I)
10    CONTINUE
      CALL SPCMOD
      CALL LEGLIN
      CALL CURVE  (X, Y, 13, 1)
      DO 30 J=1,6
        DO 20 I=1,49
          READ(1,*)X(I),Y(I)
20      CONTINUE
        CALL SPCMOD
        CALL LEGLIN
        CALL CURVE (X, Y, 49, 1)
30    CONTINUE
32    CALL BLMOVE (XR+.9, 0.)
      CALL LEGEND (IPAK, 7, 7., 6.)
      CALL ENDPL  (0)
      CALL DONEPL
      END
      SUBROUTINE MYSPEC (J)
      IF (J .EQ. 1 ) CALL SETCLR ('RED')
      IF (J .EQ. 2 ) CALL SETCLR ('MAGENTA')
      IF (J .EQ. 3 ) CALL SETCLR ('BLUE')
      IF (J .EQ. 4 ) CALL SETCLR ('CYAN')
      IF (J .EQ. 5 ) CALL SETCLR ('YELLOW')
      RETURN
      END
```

Example 6


FUNCTION
POLY DEGREE
Input Points
Degree 1
Degree 2
Degree 3
Degree 4
Degree 5
Degree 6
Y - AXIS
X - AXIS
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-3
-2
-1
0
1
2
3

Interpolation

To use interpolation routines provided by DISSPLA:

Subroutine	Level at call	Level after call
CALL SPLINE	1,2,3	p/s
CALL PSPLIN	1,2,3	p/s
CALL POLY3	1,2,3	p/s
CALL POLY5	1,2,3	p/s
CALL LINEAR	1,2,3	p/s
CALL PARA3	1,2,3	p/s
CALL PARA5	1,2,3	p/s
CALL STEP	1,2,3	p/s
CALL BARS (BARWTH)	1,2,3	p/s
For smoothing: (Supply error weighting factors in blank common YDLARAY)		
CALL SMOOTH	1,2,3	p/s
CALL PSMTH	1,2,3	p/s
To change line texture:		
CALL DOT	1,2,3	p/s
CALL DASH	1,2,3	p/s
CALL CHNDOT	1,2,3	p/s
CALL CHNDSH	1,2,3	p/s
CALL RESET ('DOT') {SOLID}	1,2,3	p/s
To construct your own texture:		
CALL MRSCOD (TLENG, NMRKSP, RATRAY)	1,2,3	p/s

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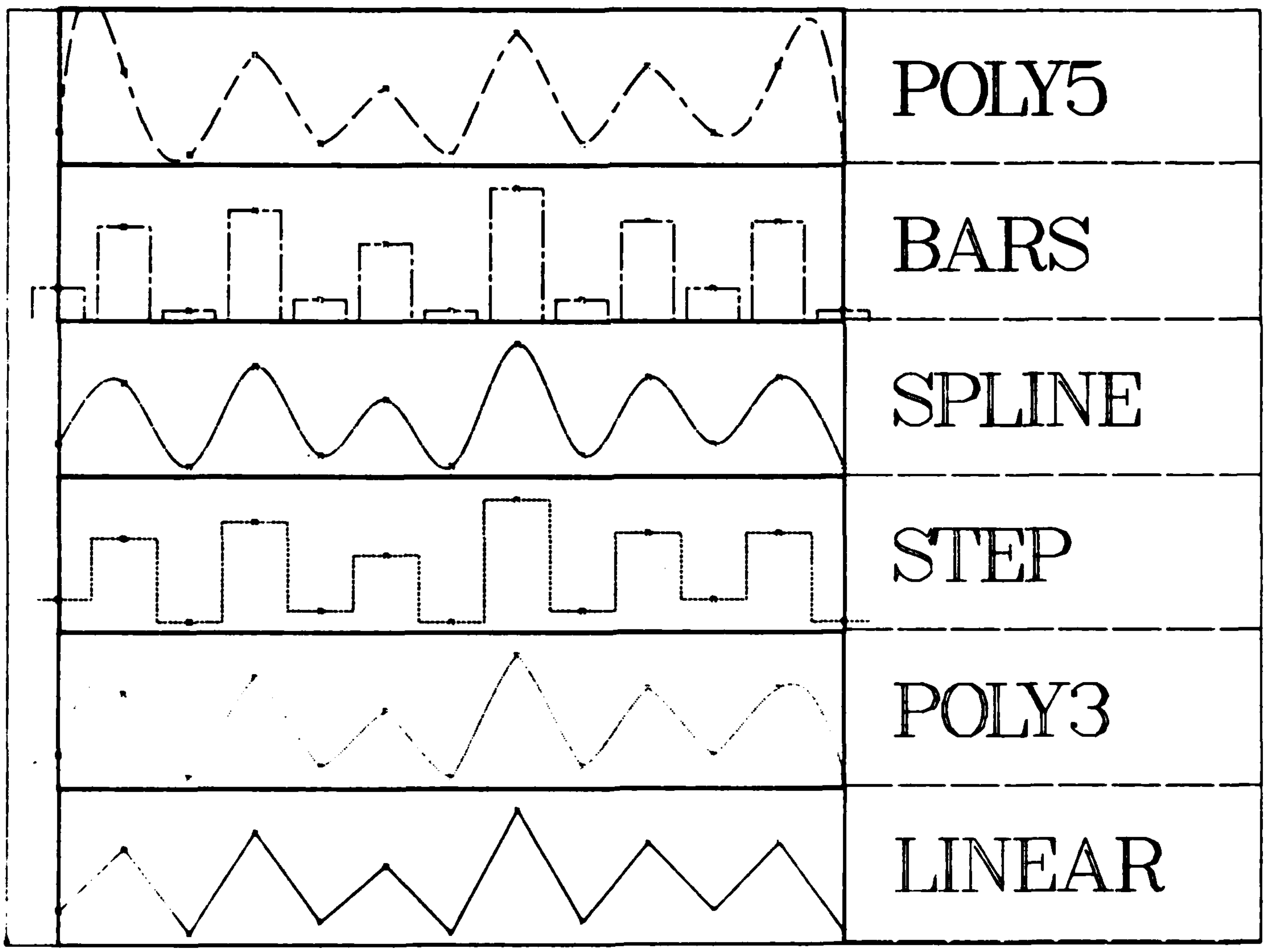
```
      PROGRAM EXAMPLE7
      DIMENSION X(13),Y(13),RATRAY(6)
      DATA X/-3.,-2.5,-2.,-1.5,-1.,-.5,0.,.5,1.,1.5,2.,2.5,3./
      DATA Y/-1.,4.5,-3.,6.,-2.,3.,-3.,8.,-2.,5.,-1.,5.,-3./
      DATA RATRAY /5., 2., 2., 2., 7., 2./
      CALL COMPRS
      CALL BGNPL   (0)
      CALL HEIGHT  (1.)
      CALL SCMPLX
      CALL PAGE    (24.0, 18.0)
      DO 30 J=1,6
       CALL PHYSOR (1., FLOAT(J-1)*3.)
       CALL AREA2D (15., 3.)
       CALL SETCLR ('GREEN')
       CALL GRAF   (-3., 1., 3., -4., 2., 10.)
       CALL FRAME
       CALL MESSAG ('_______________$', 100, 15., 0.19)
       IF ( J.EQ.1 ) THEN
           CALL LINEAR
           CALL SETCLR ('RED')
           CALL MESSAG ('LINEAR$', 100, 16., 1.)
       ELSE IF ( J.EQ.2 ) THEN
           CALL POLY3
           CALL SETCLR ('BLUE')
           CALL MESSAG ('POLY3$', 100, 16., 1.)
           CALL DOT
       ELSE IF ( J.EQ.3 ) THEN
           CALL STEP
           CALL SETCLR ('YELLOW')
           CALL MESSAG ('STEP$', 100, 16., 1.)
           CALL DASH
       ELSE IF( J.EQ.4 ) THEN
           CALL SPLINE
           CALL SETCLR ('MAGENTA')
           CALL MESSAG ('SPLINE$', 100, 16., 1.)
           CALL CHNDOT
       ELSE IF ( J.EQ.5 ) THEN
           CALL BARS   (1.)
           CALL SETCLR ('CYAN')
           CALL MESSAG ('BARS$', 100, 16., 1.)
           CALL CHNDSH
       ELSE IF ( J.EQ.6 ) THEN
           CALL POLY5
           CALL SETCLR ('YELLOW')
           CALL MESSAG ('POLY5$', 100, 16., 1.)
           CALL MRSCOD (2., 6, RATRAY)
       ENDIF
       CALL CURVE  (X, Y, 13, 1)
       CALL ENDGR  (0)
30    CONTINUE
      CALL ENDPL   (0)
      CALL DONEPL
      END
```

Example 7



Example #8 shows a polar plot of flows around a prop. The data is read in from two data files containing angles and magnitudes of the flows. A vector will be drawn for each flow, will the length being the magnitude, the direction being the angle. The data did have to be adjusted to convert to the polar coordinate system. Notice that subroutine TITLE is used even though it is is an obsolete routine it is still supported by DISSPLA. In all calls to MESSAG, the position (XVAL, YVAL) is given in polar coordinates (i.e., ANGLE, MAGNITUDE). In the call to POLAR you determine whether angles are in radians or degrees.

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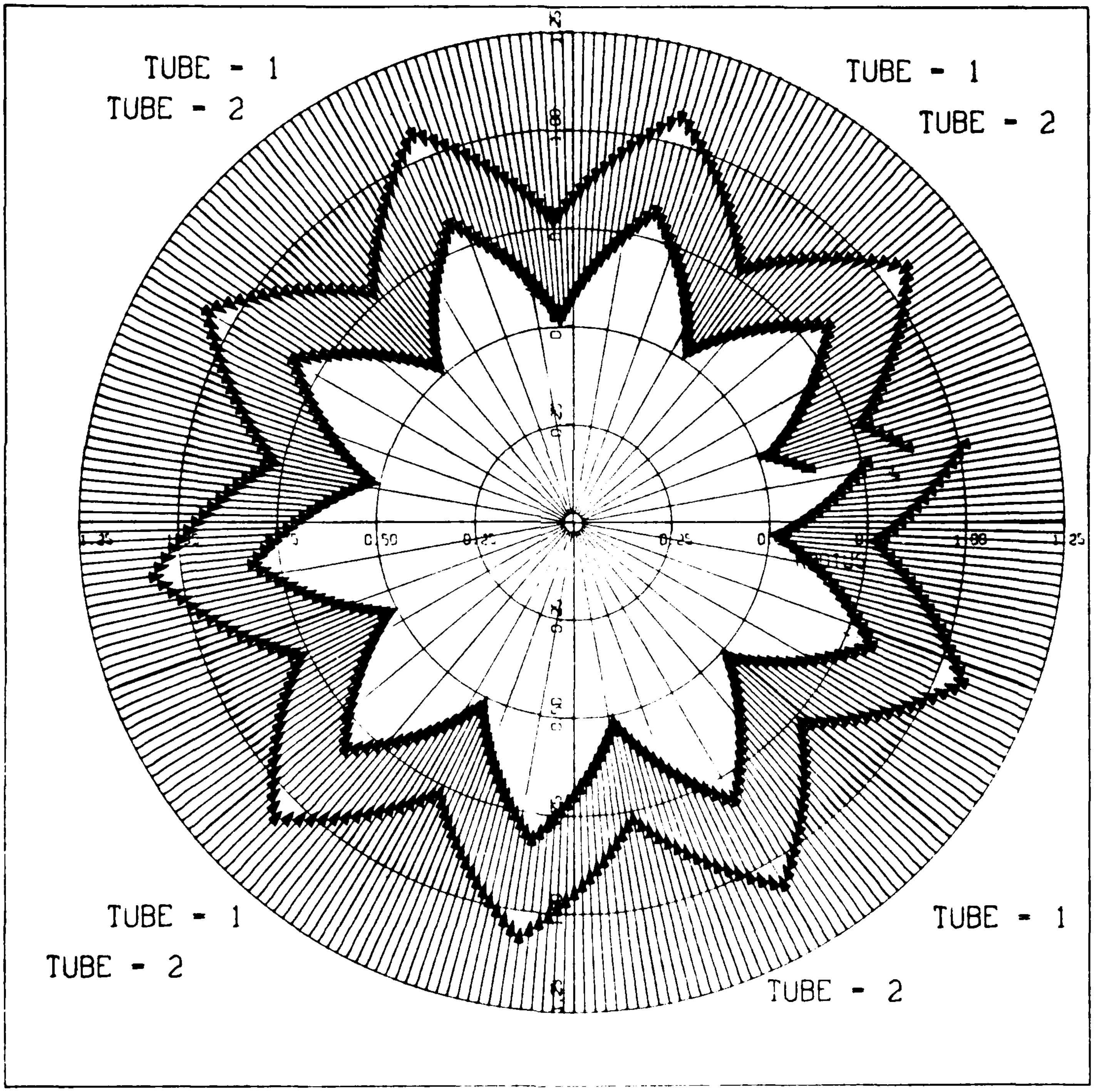
```
      PROGRAM EXAMPLE8
      OPEN(1,FILE='TUBE1.DAT',STATUS='OLD')
      OPEN(2,FILE='TUBE2.DAT',STATUS='OLD')
      CALL COMPRS
      CALL SETDEV (9, 9)
      CALL BGNPL  (1)
      CALL PAGE   (11., 11.)
      CALL SETCLR ('BLUE')
      CALL TITLE(' ',1,'RADIUS',6,1H ,1,10.5,10.5)
      CALL POLAR  (3.14159/180.,.25,5.25,5.25)
      CALL HEIGHT (.2)
      CALL SETCLR ('GREEN')
      CALL GRID   (1,1)
      DO 105,K=1,2
       IF(K.EQ.1) THEN
        CALL SETCLR ('RED')
        READ(1,'(5X,18X,I3)')INUM
        CALL RLMESS (' TUBE = ',8,60.,1.3)
        CALL INTNO  (INUM,'ABUT','ABUT')
        CALL RLMESS (' TUBE = ',8,135.,1.6)
        CALL INTNO  (INUM,'ABUT','ABUT')
        CALL RLMESS (' TUBE = ',8,220.,1.6)
        CALL INTNO  (INUM,'ABUT','ABUT')
        CALL RLMESS (' TUBE = ',8,310.,1.35)
        CALL INTNO  (INUM,'ABUT','ABUT')
       ENDIF
       IF(K.EQ.2) THEN
        CALL SETCLR ('BLUE')
        READ(2,'(5X,18X,I3)')INUM
        CALL RLMESS (' TUBE = ',8,50.,1.3)
        CALL INTNO  (INUM,'ABUT','ABUT')
        CALL RLMESS (' TUBE = ',8,140.,1.5)
        CALL INTNO  (INUM,'ABUT','ABUT')
        CALL RLMESS (' TUBE = ',8,220.,1.8)
        CALL INTNO  (INUM,'ABUT','ABUT')
        CALL RLMESS (' TUBE = ',8,290.,1.3)
        CALL INTNO  (INUM,'ABUT','ABUT')
       ENDIF
       DO 50 I=1,2500
        IF(K.EQ.1) READ(1,11,END=105)TH,R1,TH1
        IF(K.EQ.2) READ(2,11,END=999)TH,R1,TH1
        IF  (K.EQ.1)  R = 1.25
        IF  (K.EQ.2)  R = .75
        X      = R  * COSD(TH)
        Y      = R  * SIND(TH)
        X1     = R1 * COSD(180. +TH - TH1)
        Y1     = R1 * SIND(180. + TH - TH1)
        XNEW   = X + X1
        YNEW   = Y + Y1
        RNEW   = SQRT((XNEW**2)+(YNEW**2))
        THNEW  = ATAND(YNEW/XNEW)
        IF((TH.GT.0) .AND. (TH.LE.90)) THEN
         IF(THNEW.LT.0) THNEW=-THNEW
        ENDIF
        IF((TH.GT.180).AND.(TH.LE.270))THEN
         ANG = 2.
         X1 = R1*COSD(TH-TH1-ANG*(90.))
         Y1 = R1*SIND(TH-TH1-ANG*(90.))
        IF((TH.GT.180).AND.(TH.LE.270))THEN
        IF  ((X1.LT.0.).AND.(Y1.LT.0.)) THEN
         Y1    = -Y1
         X1    = -X1
        ENDIF
        XNEW = X - X1
        YNEW = Y - Y1
        RNEW = SQRT((XNEW**2)+(YNEW**2))
        THNEW = ATAND(YNEW/XNEW)
        IF(TH.GT.180).AND.(TH.LE270)) THEN
         IF(THNEW.GT.0) THNEW = THNEW+180.
        ENDIF
        ENDIF
        CALL RLVEC(TH,R,THNEW,RNEW,1201)
   50   CONTINUE
  105   CONTINUE
  999   CONTINUE
        CALL ENDPL(0)
        CLOSE(9,STATUS='DELETE')
        CALL DONEPL
        END
```

Example 8


TUBE - 1
TUBE - 2
TUBE - 1
TUBE - 2
TUBE - 1
TUBE - 2
TUBE - 1
TUBE - 2
0.50
0.25
0.25
1.00
1.25

Post-Processor

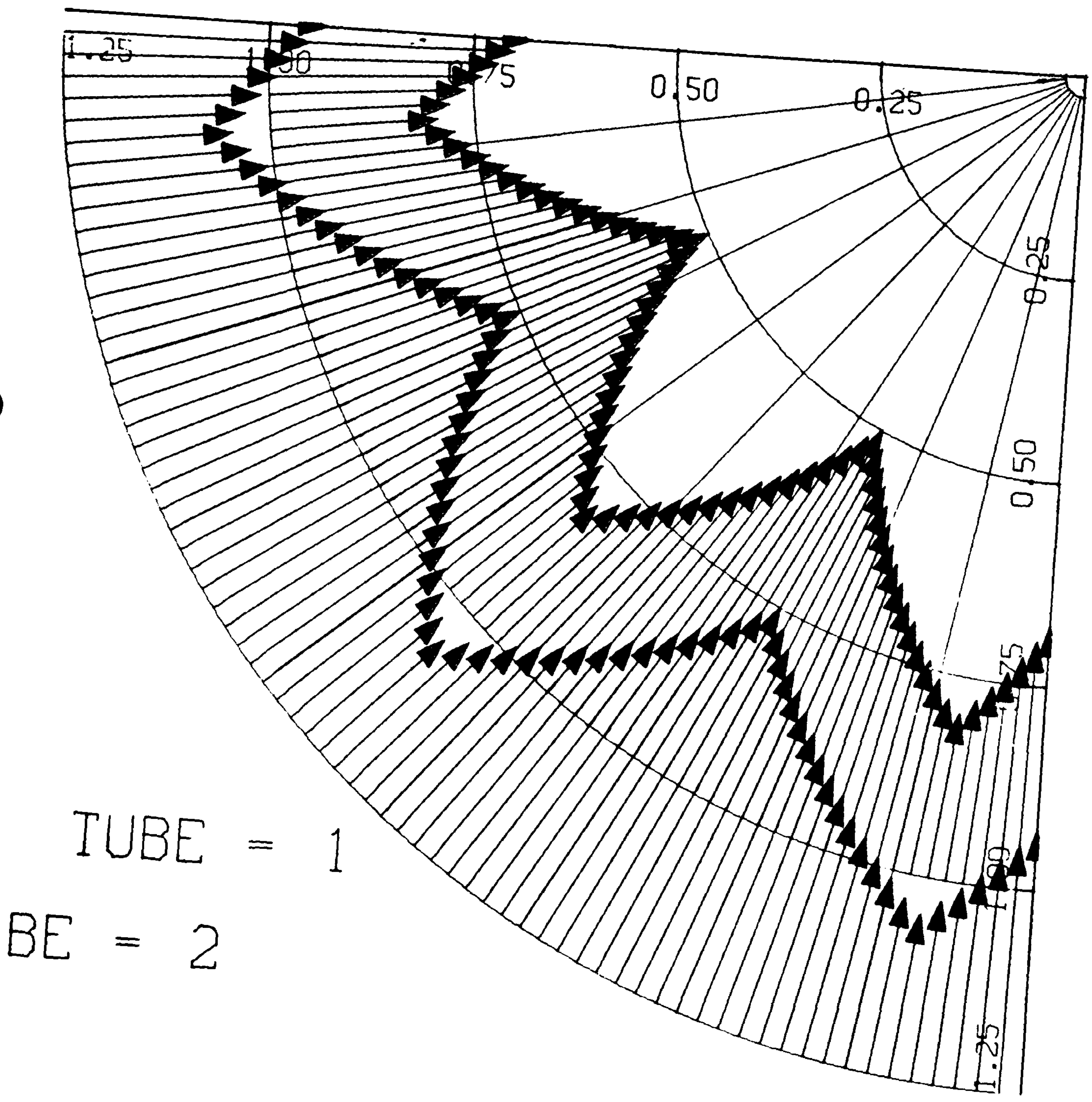
When COMPRS is used as the device, DISSPLA creates a device independent META file (called DISPLOT.DAT on VAX and PLFILE on the CYBERS). When you run the post processor, you can choose any device and make certain modifications. A plot can be scaled up or down, certain ones drawn, or a small portion of the plot "zoomed" in on.

The following command used on the preceding example would produce the following graph:

```
MODI = 1( WINDOW = UPPER(  5.75),LOWER(  0.75),
                   RIGHT(  5.75),LEFT (  0.75) * SIZE = 11,8)
```

NOTE: The graph cannot be changed (i.e., viewpoint), you can only work with the plot as it exists!

<u>Example 9</u>



3-Dimensional Plotting

Three-dimensional plotting in DISSPLA is similar to two-dimensional plotting except that some subroutines are changed to accommodate the Z coordinate arguments. There are also some additional routines to cope with 3-D plotting properties. The user wishing to use 3-D is advised to read the User's Manual.

Subroutine	Level at call	Level after call
To select relative axis lengths:		
CALL VOLM3D (X3AXIS, Y3AXIS, Z3AXIS)	2	p/s
To select a viewpoint: (Absolute units)		
CALL VUABS (XVU, YVU, ZVU)	2	p/s
CALL VUANG (PHI, THETA, RADIUS)	2	p/s
To set 3-D axis:		
CALL GRAF3D (X3ORIG, X3STEP, X3MAX, Y3ORIG, Y3STEP, Y3MAX, Z3ORIG, Z3STEP, Z3MAX)	2	3
To draw a curve:		
CALL CURV3D (XARAY, YARAY, ZARAY, N, I)	3	Same

N - Number of points to be plotted

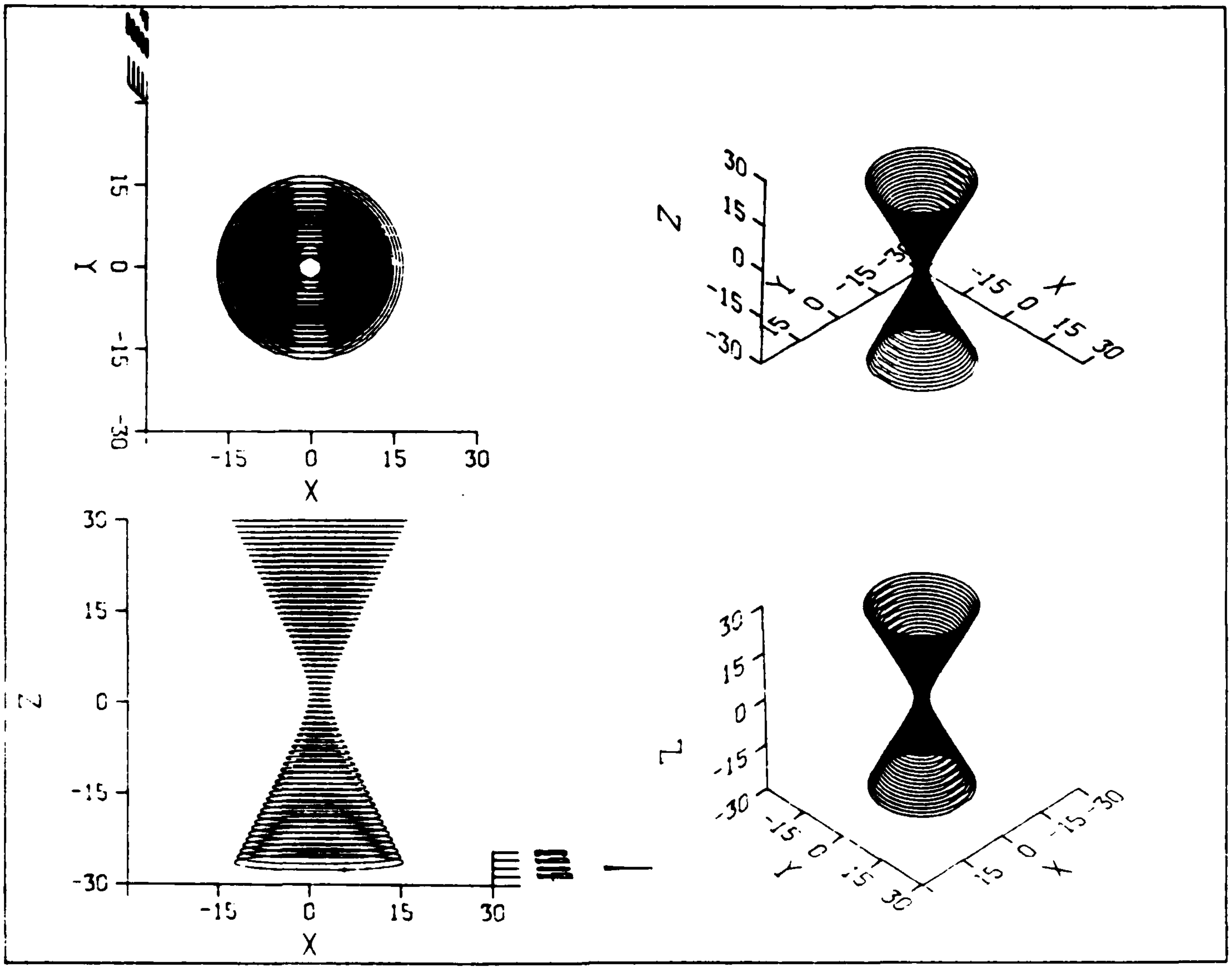
```
I - < 0   Symbol every i-th mark not connected
    = 0   No symbols just a line
    > 0   Symbol every i-th mark and connected
```

Subroutine	Level at call	Level after call
To draw 3-D Vector:		
CALL VECTR3 (XFROM, YFROM, ZFROM, XTO, YTO, ZTO, IVEC)	2,3	Same
CALL RLVEC3 (XROM, YFROM, ZFROM, XTO, YTO, ZTO, IVEC)	2,3	Same

Example #10 shows a simple 3-D plot of a conic section. Notice that along with AREA2D, AXES3D is called to define the 3-D work area. It is defined in "absolute units", so that VUABS can define the view angle relative to the work area. Four subplots will be put onto the same page, each one using a different viewpoint. The X, Y, and Z arrays are filled with the coordinates to be plotted using the equation of the conic.

```
      PROGRAM EXAMPLE10
      DIMENSION X(500), Y(500), Z(500), ZX(250)
      CALL COMPRS
      CALL BGNPL  (0)
      CALL PAGE   (14., 11.)
      CALL HEIGHT (.3)
      CALL INTAXS
      CALL ZAXANG (90.)
      DO 100 IRUNS=1,4
        CALL SETCLR ('BLUE')
        IF (IRUNS.EQ.1) THEN
          CALL PHYSOR (.5, .5)
          CALL AREA2D (6., 5.)
          CALL VUABS  (3., -30., 3.)
        ELSE IF (IRUNS.EQ.2) THEN
          CALL PHYSOR (.5, 5.5)
          CALL AREA2D (6., 5.)
          CALL VUABS  (1.5, 1.5, 30.)
        ELSE IF (IRUNS.EQ.3) THEN
          CALL PHYSOR (7.5, .5)
          CALL AREA2D (6., 5.)
          CALL VUABS  (30., 30., 30.)
        ELSE IF (IRUNS.EQ.4) THEN
          CALL PHYSOR (7.5, 5.5)
          CALL AREA2D (6., 5.)
          CALL VUABS  (-30., -30., -30.)
        ENDIF
        CALL AXES3D ('X', 1, 'Y', 1, 'Z', 1, 3., 3., 3.)
        CALL GRAF3D (-30., 15., 30., -30., 15., 30., -30., 15., 30.)
        DO 10 I=1,60
         ICOUNT =1
         DO 20 J=1,60
          ZZ = FLOAT (I-30)
          YY = FLOAT (J-30)
          XX = (((ZZ**2/16)-(YY**2/4)) + 1 ) *4
          IF(XX.GE.0) THEN
            X(ICOUNT)  = SQRT(XX)
            Y(ICOUNT)  = YY
            Z(ICOUNT)  = ZZ
            ZX(ICOUNT)= -SQRT(XX)
            ICOUNT     = ICOUNT+1
          ENDIF
20       CONTINUE
        ICOUNT = ICOUNT-1
        CALL SETCLR ('GREEN')
        DO 500 IX=1,ICOUNT
         Z(ICOUNT+IX) =  Z(ICOUNT+1-IX)
         X(ICOUNT+IX) = ZX(ICOUNT+1-IX)
         Y(ICOUNT+IX) =  Y(ICOUNT+1-IX)
500     CONTINUE
          Z(2*ICOUNT+1)=Z(1)
          X(2*ICOUNT+1)=X(1)
          Y(2*ICOUNT+1)=Y(1)
          CALL CURV3D (X, Y, Z,
     .    2 * ICOUNT+1,0)
10        CONTINUE
        CALL ENDGR (0)
100   CONTINUE
      CALL ENDPL(0)
      CALL DONEPL
      END
```

Example 10



Example #11 shows how to plot a surface defined by a function of two variables. Once the work box is set up VUANGL is called to define the viewpoint. This has the same effect as VUABS, only it uses spherical coordinates. The equation to be plotted is put in an EXTERNAL function with two arguments. The call to SURFUN contains the name of the function and will automatically compute the points to be plotted. The figure is plotted 15 times, each from a different viewpoint to simulate rotation.

Example #12 shows a single surface plot, the call to VUABS will draw the surface as if you were looking at it from (-10.,4.,20.). ZAXANG(0.) will label the Z-axis horizontally the same way YAXANG works in 2-D.

NOTE: When defining the viewpoint, you must draw the object from the outside looking in. DISSPLA will print an error message if you are within the work box (i.e., looking from the inside out).

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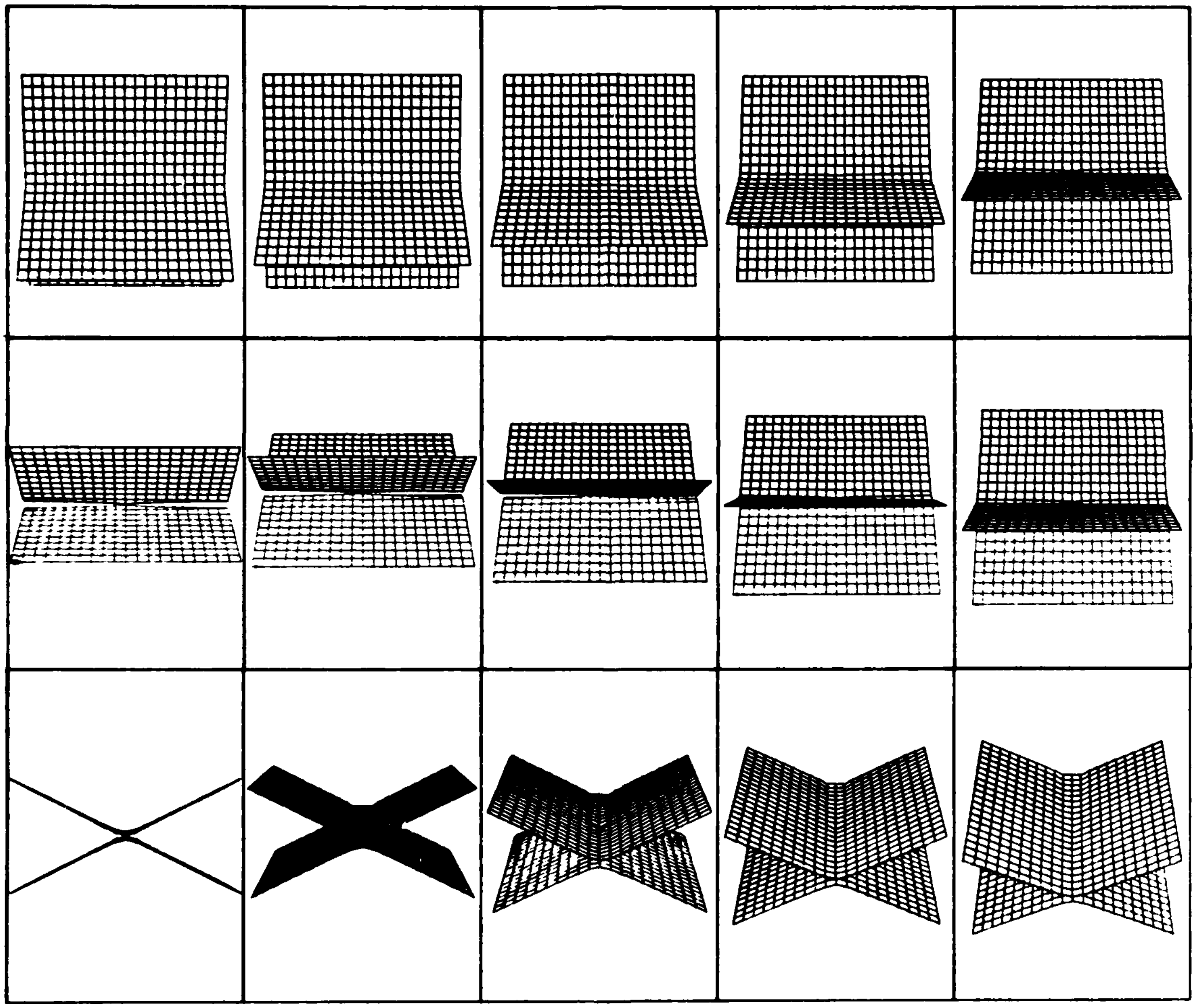
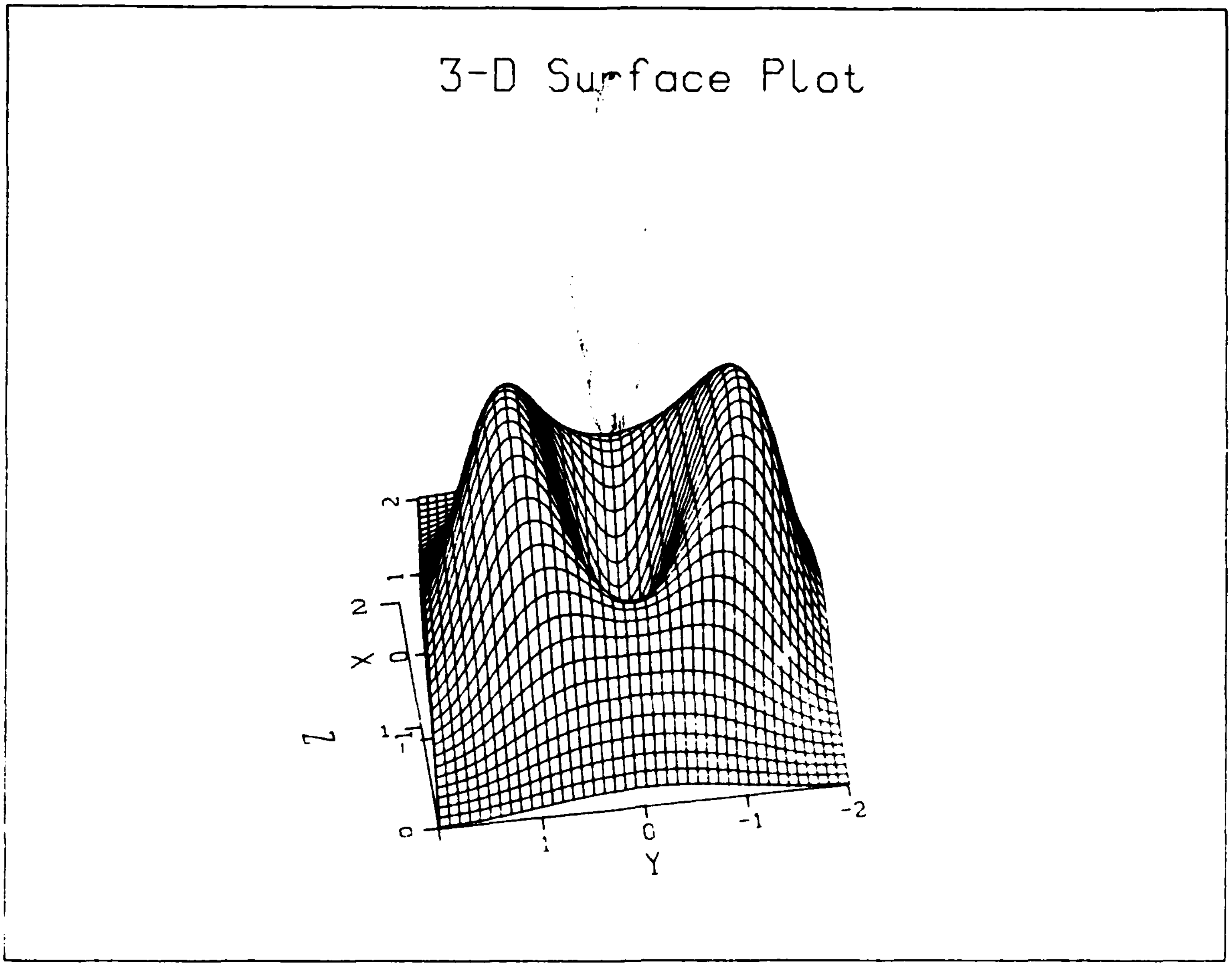
```
      PROGRAM EXAMPLE11
      EXTERNAL PYRR, PYRR1
      CALL COMPRS
      CALL BGNPL  (0)
      THETA =    0
      PHI   = -180.
      CALL PAGE   (35.5, 30.)
      DO 20 I=1,5
       DO 30 J=1,3
        CALL SETCLR  ('BLUE')
        CALL PHYSOR  (FLOAT(I-1)*(35.5/5.), FLOAT(J)*10-10)
        CALL AREA2D  (35.5/5., 30./3.)
        CALL FRAME
        CALL BLSUR
        CALL AXES3D  (0, 0, 0, 0, 0, 0, 5., 5., 5.)
        CALL VUANGL  (PHI, THETA, 20.)
        CALL GRAF3D  (-1000., 500., 1000., -1000., 500., 1000., -1000.,
     .                500.,1000.)
        CALL SETCLR  ('CYAN')
        CALL SURFUN  (PYRR, 1, 100., 1, 100., WORK)
        CALL SETCLR  ('RED')
        CALL SURFUN  (PYRR1, 1, 100., 1, 100., WORK)
        CALL ENDGR   (0)
        IF ( J.EQ.2) THEN
         THETA = 90.- I*10.
        ELSE
         PHI   = PHI + 90.
        ENDIF
30     CONTINUE
       PHI   =   -180.
       THETA = I * 10.
20    CONTINUE
      CALL ENDPL (0)
      CALL DONEPL
      END


      FUNCTION PYRR(X,Y)
      PYRR = SQRT(ABS((3*Y**2-16*X)/12))
      RETURN
      END



      FUNCTION PYRR1(X,Y)
      PYRR1 = -SQRT(ABS((3*Y**2-16*X)/12))
      RETURN
      END
```

Example 11



```
PROGRAM EXAMPLE12

EXTERNAL PYRR

CALL COMPRS

CALL BGNPL  (0)

CALL PAGE   (14., 11.)

CALL HEIGHT (.3)

CALL INTAXS

CALL ZAXANG (90.)

CALL SETCLR ('BLUE')

CALL AREA2D (10., 8.)

CALL HEADIN (' 3-D SURFACE PLOT$', 100, 1.2, 1)

CALL AXES3D ('X', 1, 'Y', 1, 'Z', 1, 5., 5., 5.)

CALL VUABS  (-10., 4., 20.)

CALL GRAF3D (-2., 1., 2., -2., 1., 2., 0., 1., 2.)

CALL SETCLR ('RED')

CALL SURFUN (PYRR, 2, .1, 2, .1, WORK)

CALL ENDPL  (0)

CALL DONEPL

END

FUNCTION PYRR(X,Y)

PYRR  = (X**2+2*Y**2)*EXP(1-X**2-Y**2)

RETURN

END
```

Example 12



Graffiti Plots

Graffiti plots allow the user to project a 2-D plot onto a plane in 3-D. The call below defines the plane by giving three points that are on the plane.

```
CALL GRFITI (XLCORN, YLCORN, ZLCORN,
             XBASEX, YBASEX, ZBASEX,
             XOTHER, YOTHER, ZOTHER)
```

XLCORN, YLCORN, ZLCORN	- coordinates of the lower left corner of the plane in absolute workbox units.
XBASEX, YBASEX, ZBASEX	- coordinates of a point on the X-axis in absolute workbox units.
XOTHER, YOTHER, ZOTHER	- coordinates of a point in the plane above the X-axis in absolute workbox units.

Example #13 shows a 3-D graffiti plot. It is important to note that when drawing a graffiti plot, the 2-D plot must be finished (CALL END3GR) before 3-D plotting or another 2-D plot can be started. The workbox is defined to be 5 X 5 X 5, the first graffiti plot defines the 2-D plane (0,5,0) (5,5,0) (2,5,2) which is the Z-X plane when Y is equal to 5. A grid is drawn on the plane and a message written before it is ended by END3GR. Then the second plane is defined, the Y-Z plane when X is 5. A grid is again drawn on the plane and the message written before it is ended by END3GR. Finaly the third plane is defined, the X-Y plane when Z is zero, and the same events occur. After the final call to END3GR the 3-D plotting can begin.

Example #14 shows a graffiti plot with actual graphs.

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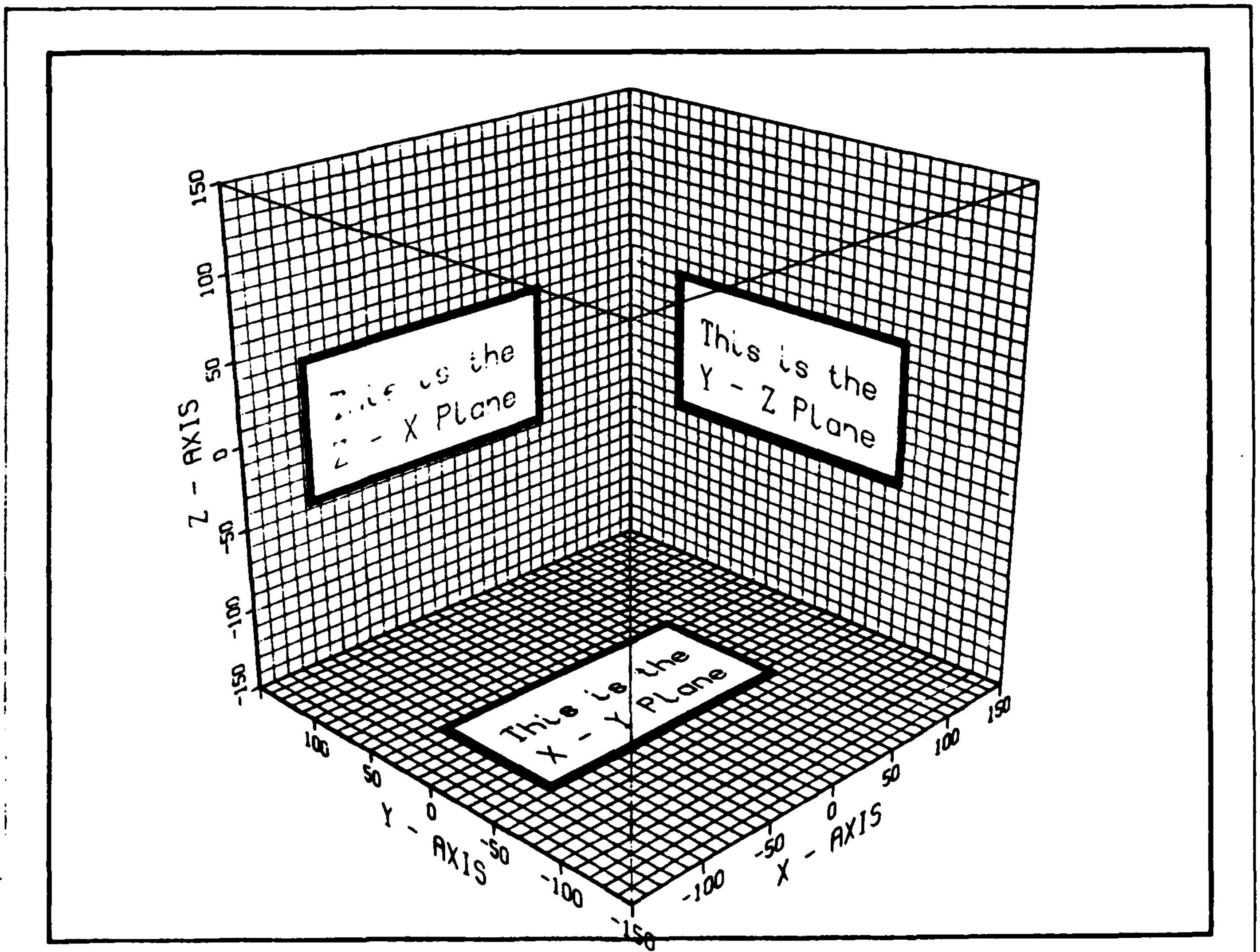
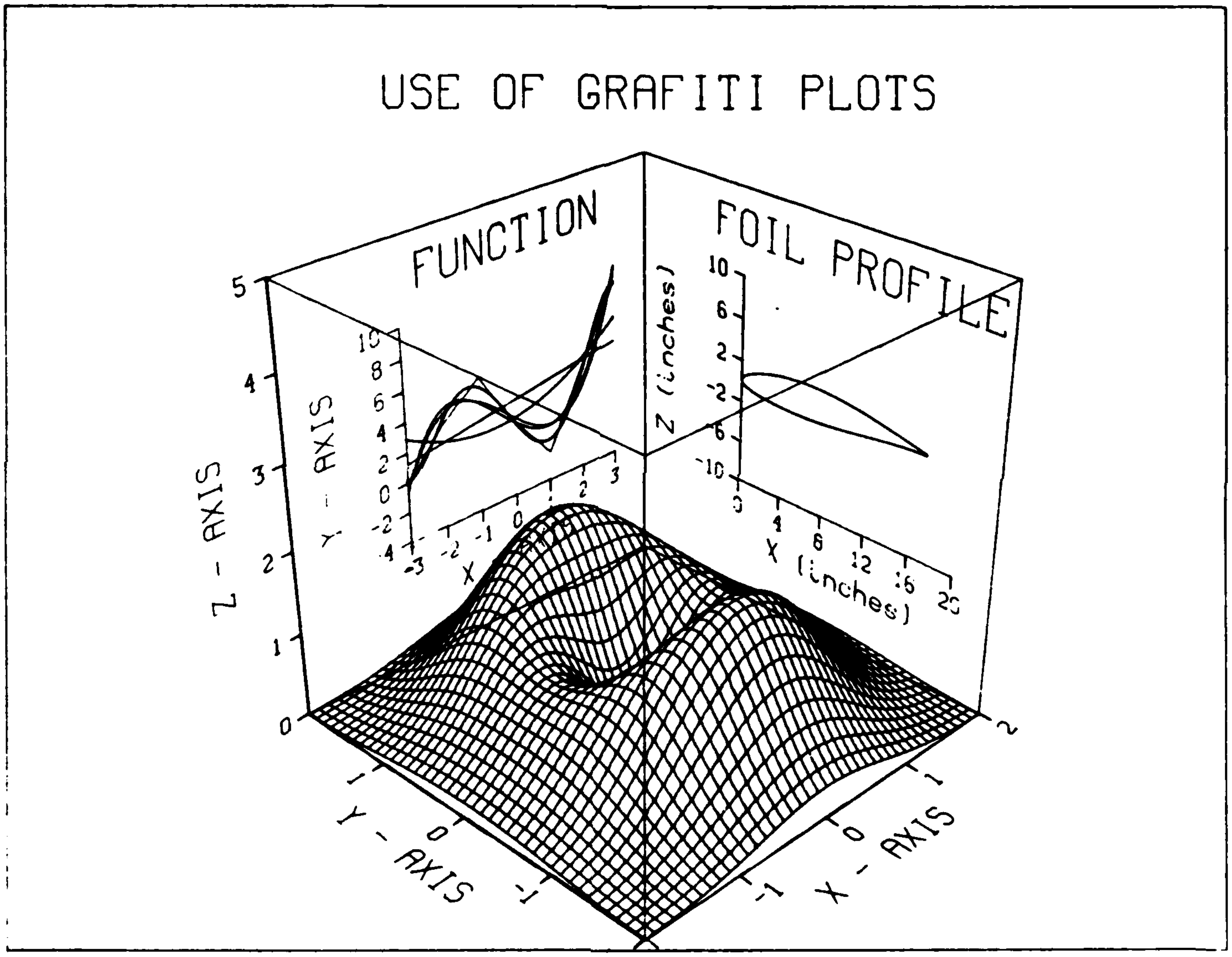
```
PROGRAM EXAMPLE13
CALL TK41    (4105)
CALL BGNPL   (0)
CALL PAGE    (14., 11.)
CALL SETCLR ('BLUE')
CALL PHYSOR (.5, .5)
CALL HEIGHT (.25)
CALL INTAXS
CALL AREA2D (13., 10.)
CALL SETCLR ('RED')
CALL FRAME
CALL AXES3D ('X - AXIS',8,'Y - AXIS',8,'Z - AXIS',8,5.,5.,5.)
CALL VUABS  (-10., -10., 10.)
CALL GRAF3D (-150.,50.,150.,-150.,50.,150.,-150.,50.,150.)
CALL GRFITI (0., 5., 0., 5., 5., 0., 2., 5., 2.)
   CALL AREA2D (5., 5.)
   CALL GRAF   (-150., 10., 150., -150., 10., 150.)
   CALL SETCLR ('GREEN')
   CALL MESSAG ('THIS IS THE$', 100, 1., 2.5)
   CALL MESSAG ('Z - X PLANE$', 100, 1., 2.)
   CALL BLREC  (.7, 1.7, 3., 1.5, .08)
   CALL GRID   (1, 1)
   CALL END3GR (0)
CALL GRFITI (5., 5., 0., 5., 0., 0., 5., 2., 2.)
   CALL AREA2D (5., 5.)
   CALL GRAF   (-150.,10.,150.,-150.,10.,150.)
   CALL SETCLR ('YELLOW')
   CALL MESSAG ('THIS IS THE$', 100, 1., 2.5)
   CALL MESSAG ('Y - Z PLANE$', 100, 1., 2.)
   CALL BLREC  (.7, 1.7, 3., 1.5, .08)
   CALL GRID   (1, 1)
   CALL END3GR (0)
CALL GRFITI (0., 0., 0., 5., 0., 0., 0., 5., 0.)
   CALL AREA2D (5., 5.)
   CALL GRAF   (-150.,10.,150.,-150.,10.,150.)
   CALL SETCLR ('BLUE')
   CALL MESSAG ('THIS IS THE$', 100, 1., 2.5)
   CALL MESSAG ('X - Y PLANE$', 100, 1., 2.)
   CALL BLREC  (.7, 1.7, 3., 1.5, .08)
   CALL GRID   (1, 1)
   CALL END3GR (0)
CALL SETCLR ('CYAN')
CALL BOX3D
CALL ENDPL  (0)
CALL DONEPL
END
```

Example 13


This is the
Z - X Plane
This is the
Y - Z Plane
This is the
X - Y Plane
Z - AXIS
Y - AXIS
X - AXIS
150
100
50
0
-50
-100
-150

Example 14


USE OF GRAFITI PLOTS
FUNCTION
FOIL PROFILE
Z - AXIS
Y - AXIS
X - AXIS
Z (inches)
X (inches)

Character Sets

DISSPLA contains numerous alphabets and character styles. Consult the User's Manual for examples of each.

Subroutine	Level at call	Level after call
CALL CARTOG	1,2,3	p/s
CALL SIMPLX	1,2,3	p/s
CALL SCMPLX	1,2,3	p/s
CALL COMPLX	1,2,3	p/s
CALL DUPLX	1,2,3	p/s
CALL TRIPLX	1,2,3	p/s
CALL GOTHIC	1,2,3	p/s

Then to choose an alphabet:

CALL BASALF (LALPHA)	1,2,3	p/s

where LALPHA is:

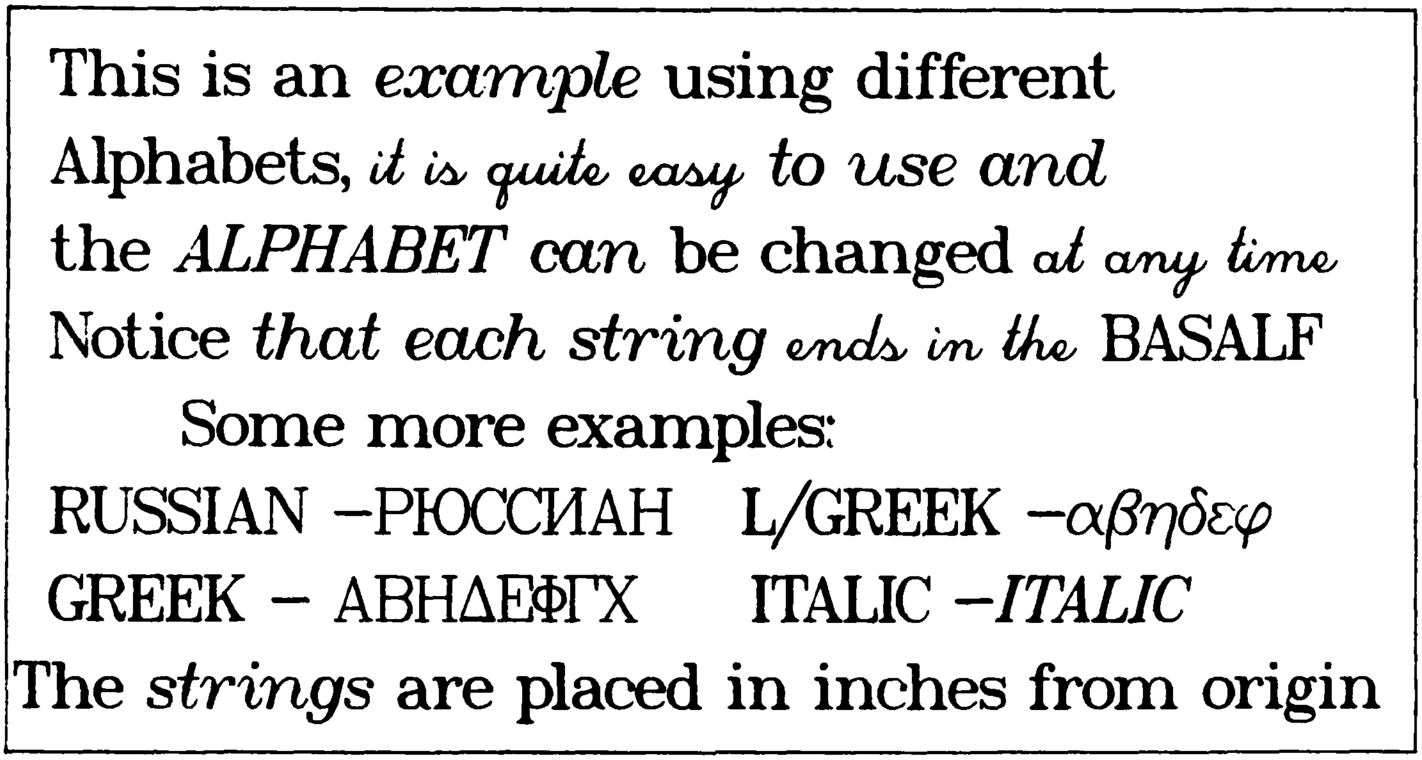
"STANDARD" "L/CSTD" "GREEK" "L/CGREEK" "RUSSIAN" "L/CRUSSIAN" "HEBREW"

"ITALIC" "L/CITALIC" "SCRIPT" "SPECIAL" "MATHEMATIC" "INSTRUCTION"

Example #15 shows how to use several alphabets, and how to change from one to another. The user must call MXIALF with the alphabet chosen and a character to represent it. At this point, any time you write out text, this character causes DISSPLA to switch to the alphabet it represents. In each call to MESSAG, these special characters are not printed but the words appear in different alphabets. Each string must end in the BASALF to use the "$" string counter feature.

```
      PROGRAM EXAMPLE15
      CALL COMPRS
      CALL SETDEV (1, 1)
      CALL BGNPL  (0)
      CALL TRIPLX
      CALL BASALF ('STANDARD')
      CALL MX1ALF ('STANDARD', '+')
      CALL MX2ALF ('L/CGREEK', '#')
      CALL MX3ALF ('RUSSIAN', '/')
      CALL MX4ALF ('SCRIPT', '&')
      CALL MX5ALF ('GREEK', '$')
      CALL MX6ALF ('ITALIC', '!')
      CALL SETEND (';', 1)
      CALL HEIGHT (.5)
      CALL PAGE   (16., 8.5)
      CALL PHYSOR (0., 0.)
      CALL AREA2D (16., 8.5)
      CALL SETCLR ('BLUE')
      CALL MESSAG ('THIS IS AN !EXAMPLE+ USING DIFFERENT;', 100,
     .             .5, 7.5)
      CALL MESSAG ('ALPHABETS, &IT IS QUITE EASY !TO USE AND+;',
     .             100, .5, 6.5)
      CALL MESSAG ('THE !ALPHABET CAN +BE CHANGED &AT ANY TIME+;',
     .             100, .5, 5.5)
      CALL MESSAG ('NOTICE !THAT EACH STRING &ENDS IN THE +BASALF;',
     .             100, .5, 4.5)
      CALL SETCLR ('RED')
      CALL MESSAG ('SOME MORE EXAMPLES:;', 100, 2., 3.5)
      CALL MESSAG ('RUSSIAN -/RUSSIAN+   L/GREEK -#ABCDEF+;',
     .             100, .5, 2.5)
      CALL MESSAG ('GREEK - $ABCDEFGH     +ITALIC -!ITALIC+;',
     .             100, .5, 1.5)
      CALL SETCLR ('BLUE')
      CALL MESSAG ('THE !STRINGS+ ARE PLACED IN INCHES FROM ORIGIN;',
     .             100, .1, .5)
999   CALL ENDPL   (0)
      CALL DONEPL
      CLOSE(1,STATUS='DELETE')
      STOP
      END
```

Example 15



This is an *example* using different

Alphabets, *it is quite easy to use and*

the *ALPHABET can* be changed *at any time*

Notice *that each string ends in the* BASALF

Some more examples:

RUSSIAN –РЮССИАН L/GREEK –$\alpha\beta\eta\delta\varepsilon\varphi$

GREEK – ΑΒΗΔΕΦΓΧ ITALIC –*ITALIC*

The *strings* are placed in inches from origin

Instruction Alphabet

This next example shows the power of the instruction alphabet. The user can choose any alphabet, spacing, height or font through commands similar to those of multiple alphabets. The commands are enclosed in parentheses and operate only on the line they appear in. Below are the commands that were used for example 16, for a complete list refer to the reference manual or page B-24 of the Pocket Guide.

Pi - set the i-th tab at the current position horizontally. (i<20)

Gi - move back to the i-th tab previously set by P. (i<20)

Er - move up (superscript) from base line a distance r.

Lr - move down (subscript) from base line a distance r.

Yr - skew character by factor r=x/y.

Ui - underline once from i-th P tab to current position.

Di - double underline from i-th P tab to current position.

Fi - Font changed to corresponding style:

0 - Default	8 - FUTURA
1 - CARTOG	9 - SERIF
2 - SIMPLX	10 - FASHON
3 - SCMPLX	11 - LOGO1
4 - COMPLX	12 - SWISSL
5 - DUPLX	13 - SWISSM
6 - TRIPLX	14 - SWISSB
7 - GOTHIC	

NOTE: If a shaded font is used it must be called prior to use.

Mi - Set character set to specified alphabet:

0 - STANDARD	7 - L/CGREEK
1 - L/CSTD	8 - RUSSIAN
2 - ITALIC	9 - L/CRUSSIAN
3 - L/CITALIC	10 - SPECIAL
4 - SCRIPT	11 - MATHEMATIC
5 - L/CSCRIPT	12 - HEBREW
6 - GREEK	13 - ALFBET

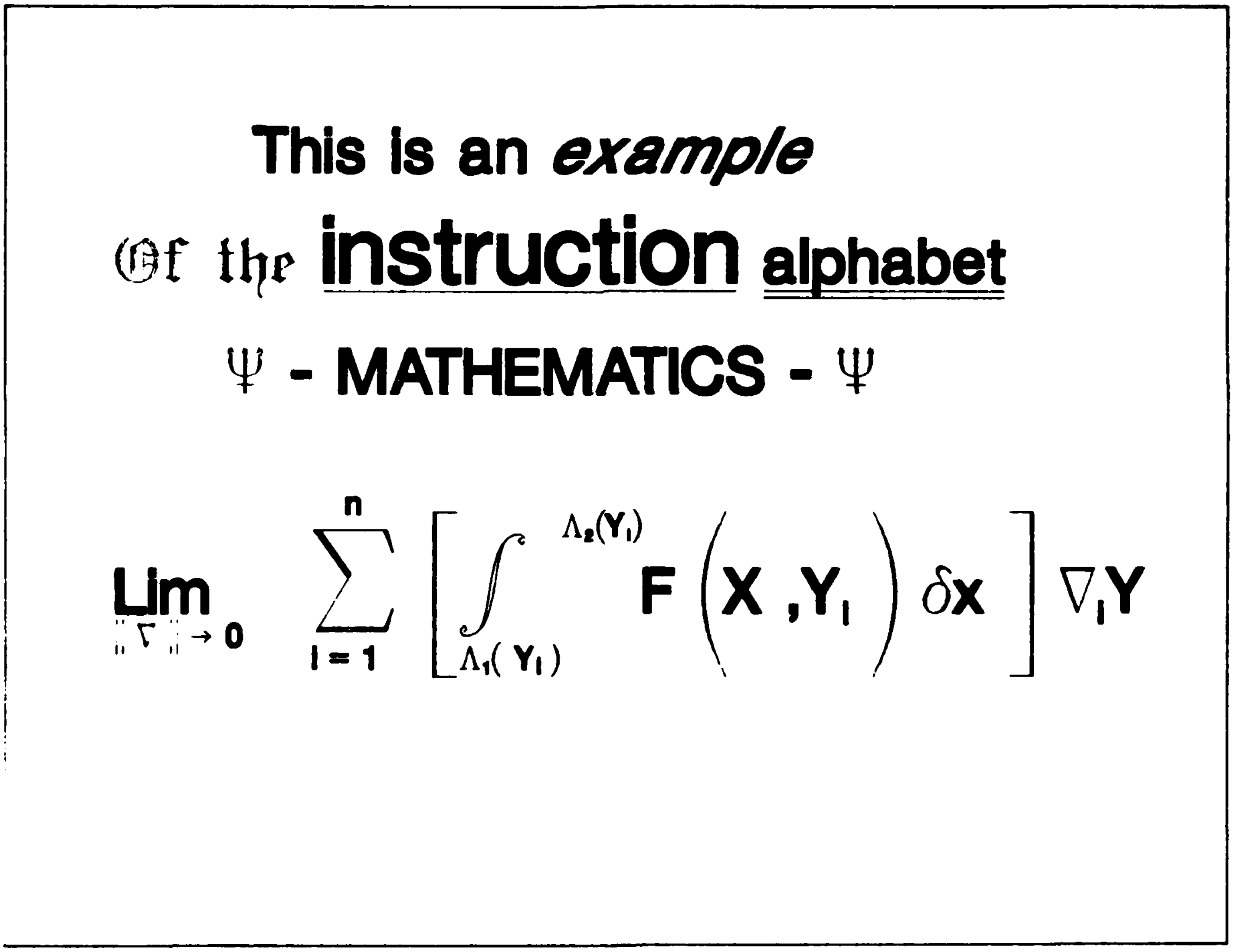
X - as an argument, resets instruction to default value.

Example #16 writes out text in various styles using the instruction alphabet. Text can be slanted, underlined and at different heights. Also, the mathematical formula is written out using the mathematical character set (see manual). If time is taken to learn the instruction alphabet, the user can benefit by having every style of character DISSPLA can produce available to him throughout his plot.

```
      PROGRAM EXAMPLE16
      CALL TK41   (4105)
      CALL SETDEV (1, 1)
      CALL BGNPL  (0)
      CALL MIXALF ('INSTRU')
      CALL HEIGHT (.2)
      CALL PAGE   (11., 8.5)
      CALL PHYSOR (0., 0.)
      CALL AREA2D (11.0, 8.5)
      CALL SETCLR ('GREEN')
      CALL MESSAG ('(H2F6MOC) THIS IS AN(Y.5) EXAMPLE(YO.)$',
     . 100,2.,7.0)
      CALL MESSAG ('(H2F7MO)OF THE  (F6P1H3)INSTRUCTION(H2U1)  (P2)
     .              ALPHABET(D2)$', 100, 1., 6.)
      CALL MESSAG ('(H2F6M10C)E  (MO)- MATHEMATICS -  (M10)E$',
     .              100, 2., 5.)
      CALL SETCLR ('RED')
      CALL MESSAG ('(MOF6H2P1)LIM(G1L1.5H1M11)L R L T  (MO)O(H3)
     .              (M11)  (P2E.2)S  (G2MOL2.5H1)I = 1(G2LXE4.5S3)N
     .              (EXM11H2S3)2$', 100, 1., 3.0)
      CALL MESSAG ('(F6H3M11P3)I(G3L2.5M6H1)L(L2.7H.5MO)1
     .              (H1L2.5M10F6)8  (MO)Y(L2.7H.7)I  (L2.5M10H1)9
     .              (G3LXE3.5H1M6S7)L(E3.3H.5MO)2(E3.5M10H1)8(MO)Y
     .              (E3.3H.5)I(E3.5H1M10)9$', 100, 'ABUT', 'ABUT')
      CALL MESSAG ('(F6EXMOH2)F(M11)8(MO)X  ,Y(L.5H1F6)I(S2)$',
     .              100, 'ABUT', 'ABUT')
      CALL MESSAG ('(LXH2M11F6)9(MO)  DX(M11H2)  3(M11)  R(MOL.5H1)I
     .              (LXH2)Y$', 100, 'ABUT', 'ABUT')
999   CALL DONEPL
      CLOSE(1,STATUS='DELETE')
      STOP
      END
```

<u>NOTE</u>: in the call to MESSAG, when ABUT is given as the position for the X and Y value, the message is placed where the previous message left off.

Example 16



This is an *example*

Of the instruction alphabet

Ψ - MATHEMATICS - Ψ

$$\lim_{\|\Gamma\| \to 0} \sum_{I=1}^{n} \left[\int_{\Lambda_1(Y_I)}^{\Lambda_2(Y_I)} F\left(X, Y_I\right) \delta X \right] \nabla_I Y$$

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